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Popular Woodworking

JUNE 2022 | #265

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- Motor: ⅓ HP, 120V, single-phase, 5.1A
- Swing: 12"
- Spindle taper: MT#2
- Spindle travel: 3½"
- Spindle speeds: Variable, 400 - 2700 RPM
- Drill chuck: 1/32" - 5/8", JT3, keyless
- Drilling capacity: 5/8" mild steel
- Max. distance from spindle to table: 13¼"
- Table dimensions: 9⅝" x 9⅝"
- Table tilt: 45° left/right
- Table swivel around column: 360°
- T-slots: (x4) ½", X pattern
- Overall dimensions: 13" W x 22" D x 36" H
- Approx. shipping weight: 93 lbs.

⚠WARNING! †1

T31739 ONLY $545.00

$69 SHIPPING

14" HEAVY-DUTY FLOOR DRILL PRESS

- Motor: ¾ HP, 120V, single-phase, 7.5A
- Swing: 14"
- Spindle taper: MT #2
- Spindle travel: 3¼"
- Number of speeds: 12, 140–3050 RPM
- Drilling capacity: ¾" steel
- Drill chuck: 3/64"–5/8"
- Table tilts: 90° left and right
- Table swing: 360°
- Table size: 11⅜" x 11⅜"
- Footprint: 18" x 11"
- Overall height: 64"
- Approx. shipping weight: 156 lbs.

MADE IN AN ISO 9001 FACTORY

CSA C US 184841

⚠WARNING! †1

G7944 ONLY $615.00

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13-1/4" OSCILLATING DRILL PRESS

- Motor: ¾ HP, 110V, single-phase, 9A
- Swing: 13¼"
- Drill chuck: 1–16mm
- Drilling capacity: 5/8"mild steel
- Spindle taper: JT-33
- Spindle travel: 3⅛"
- Oscillating stroke length: ¾"
- Number of speeds: 12 (250–3050 RPM)
- Column diameter: 2.79"
- Table: Round, 12⅜" Dia.
- Table swing: 360 degrees
- Table tilts: 90 degrees in both directions
- Footprint: 11" W x 17½" L
- Overall dimensions: 15" W x 24" L x 38" H
- Approx. shipping weight: 123 lbs.

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2-Year Warranty!

⚠WARNING! †1

W1668 ONLY $699.99

DOUBLE AIR FILTER WITH REMOTE CONTROL

- Motor: ⅓ HP, 120V, single-phase, 3A
- Airflow performance: 1400 CFM
- Primary filter rating: 5-micron
- Secondary filter rating: 1-micron
- Overall size is 30⅛" W x 19⅞" D x 16⅜" H
- Approx. shipping weight 74 lbs.

CSA C US 247570

MADE IN AN ISO 9001 FACTORY

⚠WARNING! †1

G9956 ONLY $514.00

$149 SHIPPING

1-1/2 HP WALL-MOUNT DUST COLLECTOR WITH CANISTER FILTER

SPECIFICATIONS

- Motor: 1½ HP, 110V, single-phase, 15A
- Airflow capacity: 1250 CFM
- Max. static pressure: 10.4"
- Filtration rating: 1-micron
- Bag capacity: 15-gallon
- Overall dimensions: 22½" W x 23½" D x 77½" H
- Approx. shipping weight: 77 lbs.

FEATURES

- Built-in canister cleaner maintains canister life and performance
- ON/OFF remote control

⚠WARNING! †1

G0944 ONLY $645.00

3 HP DOUBLE CANISTER DUST COLLECTOR

- Motor: 3 HP, 240V, single-phase, 12A
- Main inlet size: 7" with three 4" adapter inlets
- Airflow capacity: 1429 CFM @ 3.2" SP
- Maximum static pressure: 12"
- Filtration rating: 1-micron
- Filter surface area: 160 sq. ft.
- Impeller: 12¾" radial fin
- Machine collection capacity at same time: 3
- Material collection capacity: 67 gallons
- Sound rating 81-83dB
- Overall dimensions: 58" W x 31½" D x 76" H
- Approx. shipping weight: 237 lbs.

⚠WARNING! †1

2-Year Warranty!

SB1101 ONLY $1850.00

$189 SHIPPING

10" 1/2 HP BANDSAW

- Motor: ½ HP, 120V, single-phase, 3.5A
- Max. cutting width left of blade: 9¾"
- Max. cutting height (resaw capacity): 6⅛"
- Blade speeds: 2, 1520 and 2620 FPM
- Blade size: 71½"–72½" (⅛"–½" wide)
- Table size: 14 3/16" x 12⅝"
- Table tilt: 0–45°
- Footprint: 24½" x 20½"
- Overall dimensions: 28" W x 21½" D x 58½" H
- Approx. shipping weight: 75 lbs.

MADE IN AN ISO 9001 FACTORY

⚠WARNING! †1

G0948 ONLY $390.00

$25 SHIPPING

14" 1 HP DELUXE BANDSAW

- Motor: 1 HP, 110V/220V (prewired 110V), single-phase, 11A/5.5A
- Max. cutting width left of blade: 13½"
- Max. cutting height (resaw capacity):6"
- Table size: 14" x 14"
- Table tilt: 10° left, 45° right
- Floor-to-table height: 43"
- Blade size: 93½" (⅛"–¾" wide)
- Blade speed: 1800 and 3100 FPM
- Overall dimensions: 27" W x 30" D x 67½" H
- Approx. shipping weight: 246 lbs.

CSA C US 177335

⚠WARNING! †1

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- Max. cutting height (resaw capacity): 12"
- Table size: 23⅝" x 17¼" x 1½" thick
- Table tilt: 5° left, 45° right
- Floor to table height: 37½"
- Blade size: 131½" long
- Blade sizes available: ⅛"–1" wide
- Blade speed: 1700 and 3500 FPM
- Footprint: 27" L x 17¾" W
- Overall size: 32" W x 32" D x 73" H
- Approx. shipping weight: 460 lbs.

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CSA C US 181721

⚠WARNING! †1

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***To maintain machine warranty, 440V operation requires additional conversion time and a $250 fee. Please contact technical service for complete information before ordering.**

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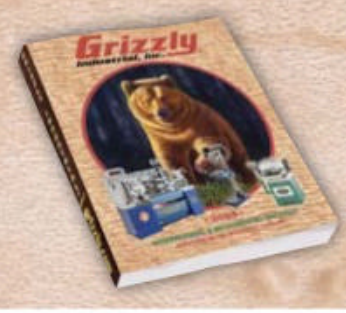

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10" 2 HP BENCHTOP TABLE SAW

- Motor: 2 HP, 120V, single-phase, 15A
- Table size: 26⅜" W x 32¼" D
- Arbor speed: variable, 2000-4000 RPM
- Blade tilt: Left, 45°
- Max. depth of cut: 3⅛" @ 90°, 2¼" @ 45°
- Rip capacity: 28" right
- Dado capacity: 13/16"
- Dust port: 2½"
- Overall size: 28" W x 37½" D x 20½" H (G0869); 41½" W x 37½" D x 41" H (G0870)
- Approx. shipping weight: 72 lbs. (G0869) 106 lbs. (G0870)

c UL us LISTED Table Saw 93K7 E98714

MADE IN AN ISO 9001 FACTORY

⚠WARNING! †[1]

G0869 ONLY $535.00 $49 SHIPPING

WITH ROLLER STAND

G0870 ONLY $705.00 $69 SHIPPING

10" 2 HP 120V HYBRID TABLE SAW

- Motor: 2 HP, 120V/240V (prewired for 120V), single-phase, 15A/7.5A
- Rip capacity: 31" right, 16¾" left of blade
- Max. depth of cut @ 90°: 3⅛"
- Max. depth of cut @ 45°: 2¼"
- Table size with extension wings: 40½" W x 27" D
- Distance from front of table to center of blade: 15½"
- Floor-to-table height: 35⅜"
- Arbor diameter: ⅝"
- Arbor speed: 3450 RPM
- Max. width of dado: 13/16"
- Dust port size: 4"
- Footprint: 21" L x 19½" W
- Overall dimensions: 64" W x 40½" D x 36" H
- Approx. shipping weight: 330 lbs.

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ETL us Intertek

⚠WARNING! †[1]

G0771Z ONLY $1595.00 $189 SHIPPING

10" 5 HP 240V CABINET TABLE SAW WITH BUILT-IN ROUTER TABLE

- Motor: 5 HP, 240V, single-phase, 23A
- Rip capacity: 32" right, 14" left of blade
- Max. depth of cut @ 90°: 3"
- Max. depth of cut @ 45°: 2⅛"
- Assembled table size: 48" W x 27" D
- Distance from front of table to center of blade: 17"
- Distance from front of table to blade at max. cut: 12"
- Floor-to-table height: 34"
- Arbor diameter: ⅝"
- Arbor speed: 4200 RPM
- Max. width of dado: 13/16"
- Dust port size: 4"
- Overall dimensions: 66" W x 47" D x 39¾" H
- Footprint: 20½" x 20½"
- Approx. shipping weight: 542 lbs.

SP C US 177335

⚠WARNING! †[1]

G1023RLWX ONLY $2650.00 $239 SHIPPING

13" 2 HP BENCHTOP PLANER WITH HELICAL CUTTERHEAD

- Motor: 2 HP, 120V, single-phase, 15A
- Max. cut width: 13"
- Min. stock length: 6"
- Min. stock thickness: 1/8"
- Max. stock thickness: 6"
- Max. cut depth full width: 1/32"
- Max. cut depth 6" wide: 3/32"
- Cutterhead type: 2" helical with 2-row spirals, 30 inserts
- Insert size and type: 15mm x 15mm x 2.5mm indexable carbide inserts
- Cutterhead speed: 8500 RPM
- Feed rate: 25 FPM
- Table size with extensions: 13" x 28"
- Dust port size: 2" with 4" adaptor
- Overall dimensions: 25½" W x 28" D x 19" H
- Approx. shipping weight: 82 lbs.

MADE IN AN ISO 9001 FACTORY

⚠WARNING! †[1]

G0940 ONLY $925.00 $69 SHIPPING

13" PLANER/MOULDER

- Motor: 1½ HP, 110V/220V (prewired 110V), single-phase,15/7.5A
- Maximum stock width: 13"
- Maximum stock thickness: 6"
- Maximum planing cutting depth: 1/8"
- Maximum moulding profile depth: ¾"
- Maximum moulding width: 4 9/16"
- Feed rate planing: 24 FPM
- Feed rate moulding: 12 FPM
- Knife size and type: 13" x ⅝" x 1/8", HSS
- Cutterhead speed: 5000 RPM
- Footprint: 22¼" x 21¼"
- Overall dimensions: 23½" W x 23" D x 44½" H
- Approx. shipping weight: 236 lbs.

MADE IN AN ISO 9001 FACTORY

⚠WARNING! †[1]

G1037Z ONLY $1335.00 $149 SHIPPING

15" 3 HP PLANER WITH CABINET STAND

- Motor: 3 HP, 230V, single-phase, 12A
- Max. stock width: 15"
- Max. stock thickness: 6"
- Min. stock thickness: 3/16"
- Min. stock length: 6"
- Max. cutting depth: 1/8"
- Cutterhead diameter: 3"
- Cutterhead type: 3-knife
- Knife size & type:15" x 1" x 1/8", HSS
- Cutterhead speed: 5000 RPM
- Feed rate: 16 & 28 FPM
- Table size with extensions: 15" x 50"
- Dust port size: 4"
- Footprint: 21½" x 21"
- Overall dimensions: 32" W x 50" D x 44" H
- Approx. shipping weight: 517 lbs.

SP C US 175370

MADE IN AN ISO 9001 FACTORY

⚠WARNING! †[1]

G1021Z ONLY $2570.00 $239 SHIPPING

6" BENCHTOP JOINTER WITH SPIRAL-TYPE CUTTERHEAD

- Motor: 1½ HP, 120V, single-phase, 10A
- Max. width of cut: 6"
- Max. depth of cut: 1/8"
- Min. workpiece length: 10"
- Min. stock thickness: ½"
- Number of cuts per minute: 72,000
- Cutterhead type: 6-Row spiral-type
- Cutterhead diameter: 2"
- Cutterhead speed: 12,000 RPM
- Cutter insert type: Indexable HSS
- Cutter insert size: 14mm x 14mm x 2mm
- Number of inserts: 12
- Table size: 6¼" x 30"
- Fence size: 19¾" L x 4 5/16" H
- Dust port size: 2½"
- Footprint: 9½" x 19½"
- Overall dimensions: 30" W x 17½" D x 13½" H
- Approx. shipping weight: 44 lbs.

SP C US 262149

⚠WARNING! †[1]

G0946 ONLY $415.00

MADE IN AN ISO 9001 FACTORY

8" X 83" HELICAL CUTTERHEAD JOINTER

- Motor: 3 HP, 220V, single-phase, 15A
- Max. width of cut: 8"
- Max. depth of cut: 1/8"
- Max. rabbeting depth: ½"
- Cutterhead diameter: 3 1/16"
- Cutterhead type: 4-row helical with 36 inserts
- Insert size, type: 15 x 15 x 2.5mm, indexable carbide
- Cutterhead speed: 7000 RPM
- Table size: 8" x 83"
- Fence size: 38" L x 4¾" H
- Min. stock length: 10"
- Min. stock thickness: ½"
- Footprint: 15" x 45¾"
- Overall dimensions: 83" W x 24½" D x 44" H
- Approx. shipping weight: 672 lbs.

SP C US 175370

MADE IN AN ISO 9001 FACTORY

⚠WARNING! †[1]

G0495X ONLY $3395.00 $239 SHIPPING

8" PARALLELOGRAM JOINTER WITH HELICAL CUTTERHEAD

- Motor: 3 HP, 230V, single-phase, 12A
- Max. width of cut: 8"
- Max.depth of cut: 1/8"
- Max. rabbeting depth: ½"
- Cutterhead diameter: 3 1/16"
- Cutterhead type: 4-row helical with 36 inserts
- Insert size & type: 15 x 15 x 2.5mm, indexable carbide
- Cutterhead speed: 7000 RPM
- Table size: 8" x 83"
- Fence size: 38" L x 4 5/8" H
- Min. stock length: 10"
- Min. stock thickness: ½"
- Dust port size: 4"
- Footprint: 18" x 46"
- Overall dimensions: 83" W x 26" D x 46" H
- Approx. shipping weight: 730 lbs.

2-Year Warranty!

SP C US 175370

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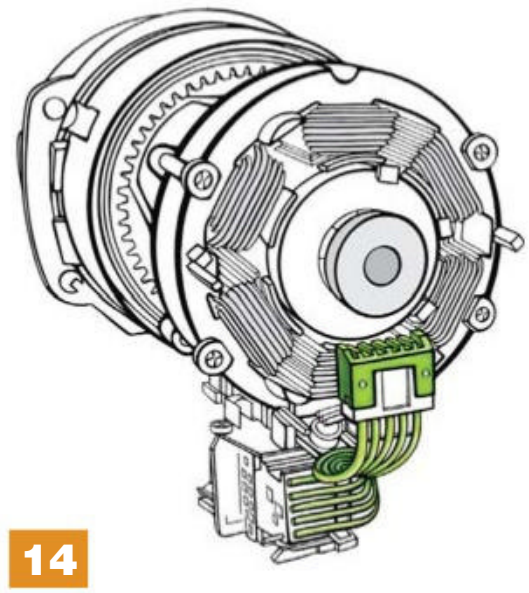

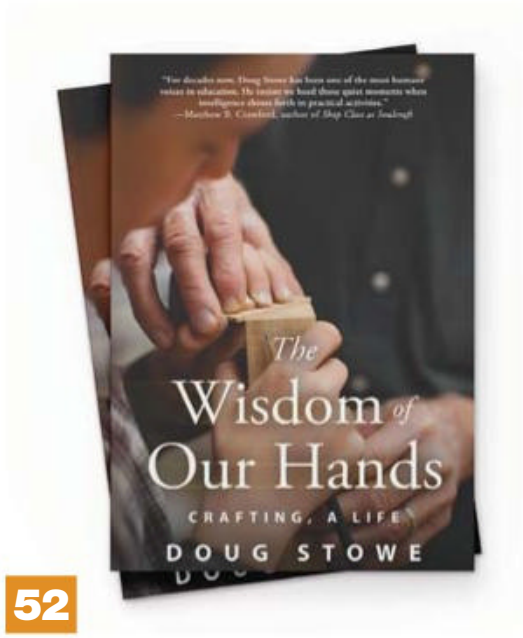

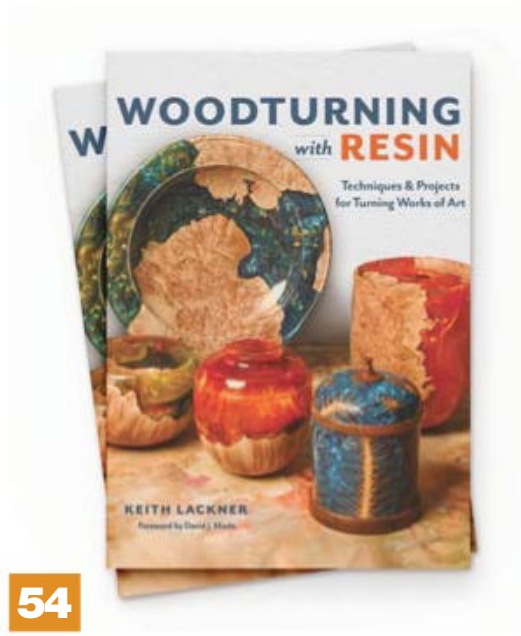

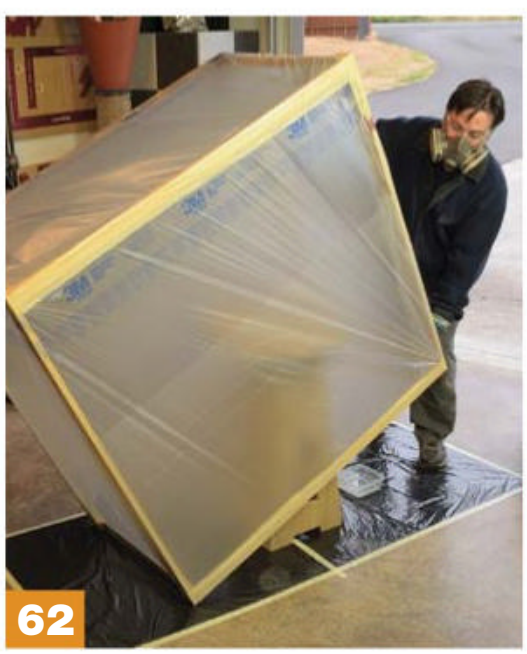

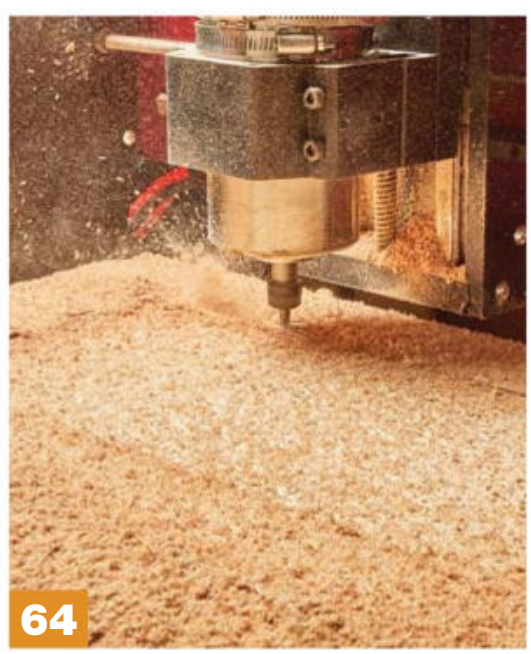

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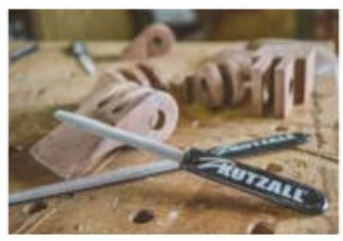

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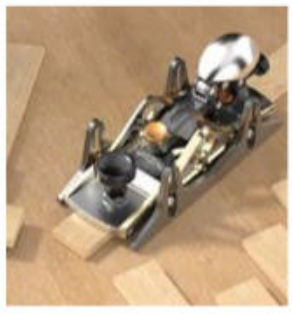

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Registration starts 12:01 am, EDT on May 20 and ends 11:59 pm EDT on June 19, 2022.

Connect

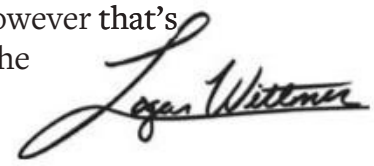
FROM THE EDITOR

Ignore the Dimensions

By Logan Wittmer

As a woodworker, I used to want to have every dimension laid out for me. I wanted to have a cut list, cut the parts to size, and put the project together. But, as I've grown as a woodworker, my opinion has shifted. Now, I realize it's much more prudent just to cut the damn parts to fit. It took a good long while, but I now realize that *some* dimensions are critical. But, everything else is derived based on those dimensions. Heck, even critical dimensions are only critical relative to something else.

So, as you flip through this issue, you'll find a couple of different projects, and all of them have dimensions. But really, don't give much thought to those. Sure, you can use them as a guidelines; however that's all they are. Cut your parts to fit—don't sweat the dimensions, just have fun building. Cheers.



ABOUT THE AUTHORS

JIMMY CLEWES: *Drum Style Box* – *pg. 22*

Hailing from England, Jimmy Clewes now resides in Las Vegas with his wife Mary and dog Seamus. Jimmy has spent the last thirty-five years traveling the world teaching and demonstrating woodturning. His quick wit and straightforward approach have made him a favorite of students from across the globe. When not hosting students at his home in Las Vegas, Jimmy's often found with a gold pan in hand, prospecting in the Vegas desert.

COLLIN KNOFF: *Battery Powered Tools* – *pg. 14*

Collin has been fascinated with building things as long as he can remember — from LEGO sets to taking apart things around the house just so he could see how they went back together (sorry Mom!). It wasn't until he took wood shop in high school, however, that he found the best way to channel that energy, and has been a maker ever since. Collin joined the *Popular Woodworking* team as the Digital Editor in 2019, and is excited to be part of the bright future ahead for the next 40 years.

WILLIE SANDRY: *Tabouret Side Table* – *pg. 34*, *Fume Finishing* – *pg. 62*

Hailing from the Pacific Northwest, Willie Sandry is a long time fan of Arts & Crafts furniture. He enjoys taking inspiration for his projects from antique furniture exhibitions as well as "old barn finds." Never one to do a job part-way, Willie has developed a vast skill set to elevate his projects. From sawing lumber and kiln drying it to finishing a chair with top-notch upholstery, Willie sees a project through from the start until finish. *YouTube: The Thoughtful Woodworker*

Popular Woodworking

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WORKSHOP TIPS

Bargain Screw Lube

A toilet bowl floor gasket is an excellent lubricant for screws—it's much more slippery than paraffin, soap, or all of the other materials I've tried. It's very soft, so all you have to do to coat a screw is push it into the ring. One gasket lasts for years. You'll find them in hardware stores and home centers. — *Robert Behm*

Thrifty Spring Clamp

This light-duty clamp is ideal for small parts and is easy to make by the dozen. All you need are a couple of wood scraps, a rubber band, and a short piece of dowel rod. You can vary the pressure by changing the position of the dowel or the rubber band and how many times you wrap it. — *Jim Tite*

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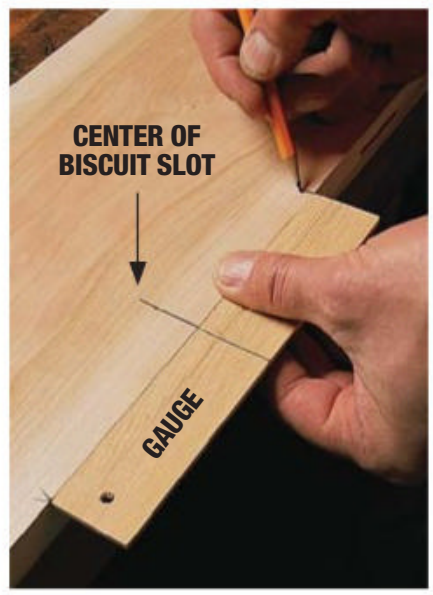
WORKSHOP TIPS

Your Router is Also a Biscuit Joiner

I love the convenience of using biscuits to align boards for a glue-up. However, I never got around to buying a biscuit joiner because I've been using my router to cut biscuit slots. Standard slot cutters don't work because biscuit slots must be a hair thinner. For less than $50 I bought a slot cutter and three interchangeable bearings (one for each size of biscuit).

Sliding the bit along the edge of the board about 1" makes a perfect biscuit slot. For layout, I use a small stick that 1" longer than my router base. I simply line up its center mark with the center mark of the biscuit slot and draw "start" and "stop" marks at either end. — *Ed Krause*



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Glue Before Stripping

When restoring old, beat-up antiques, the typical sequence is to strip, repair, and then finish. I like to change the order a bit and re-glue the loose joints and do repairs first. That way, I don't have to worry about glue squeeze out—it's taken care of when I strip the piece. Also, any new wood used in repairs gets worked up like the old wood, which helps it blend in better. After stripping, all I have to do is sand and refinish. — *Sean Daly (Providence, Rhode Island)*

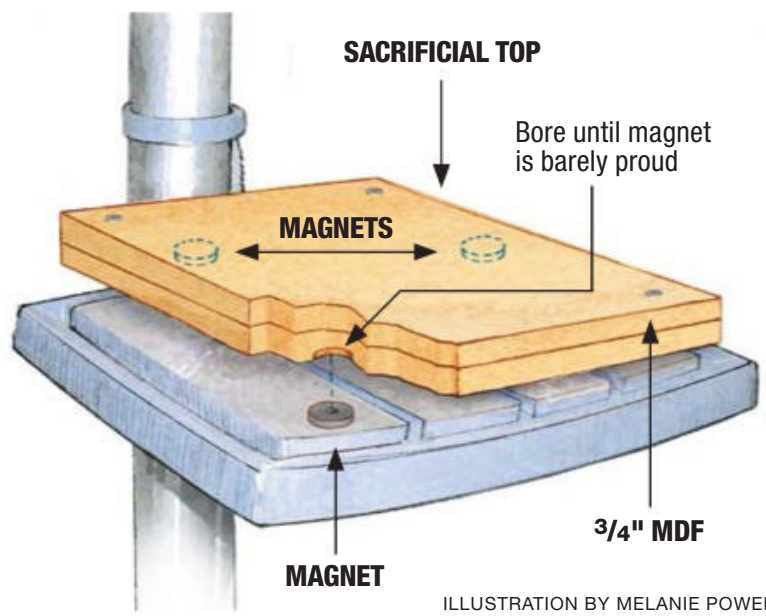
Drive Glued-Up Panels Flat

Applying clamp pressure often causes panels to lift off the bar and creep up the clamp head. Cupped or twisted panels are the result. Keep panels flat by rapping them back onto the bar with a dead-blow mallet. Each rap usually reduces the clamp's pressure, so be prepared to tighten the clamp. — *Tim Johnson*

PHOTO BY THE AUTHOR

Easy-to-Adjust Backer Board

Nothing is more frustrating than splintering out the bottom of a workpiece when drilling a hole. To avoid that issue, I move the backer board on my drill press table around a lot so I'll always have a clean spot under the hole. Tired of clamping and re-clamping my backer board to the cast-iron table of the drill press, I made a two-layer backer. The bottom layer has rare-earth magnets to hold it in place, while the top is replaceable. Once it's chewed up, I can simply swap it out for a fresh surface. — *Bruce Anderson (Alamogordo, New Mexico)*



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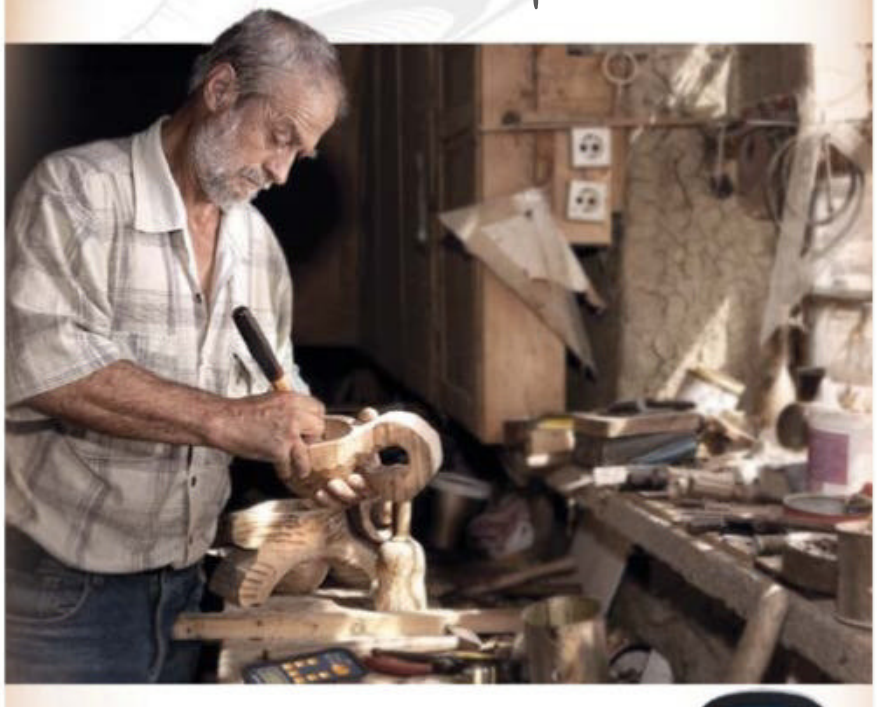

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WORKSHOP TIPS

Contoured Sanding Block

Sanding moldings can be difficult. To make a custom sanding block, I glue coarse sandpaper to several inches of the molding. Rub a block of Styrofoam on the sandpaper until the block conforms to the molding's contour. Glue sandpaper to the block, then sand the molding. This method works best on large cove moldings; small rounds or hollows can lose their definition if sanded with a large block and coarse paper. — *Tebor Narom*

Bag Your Cartridge Mask

Organic vapor cartridges work great but their useful life is only about 8 hours. That's not very long. And what's worse, they're such dedicated little buggers they actually keep right on working even when you're not wearing the mask. Give them a rest and prolong their life by storing your mask in an airtight container when not in use. A resealable plastic bag or old ice cream pail work great. — *Dave Munkittrick*

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Big Stamps Prevent Little Mix-Ups

CHARACTER STEEL STAMP SET

Purchase this 9 piece, 3/8" set from www.mscdirect.com.

You know this is the left side of the right assembly. Or is it? After dry-fitting your project for the umpteenth time, have you ever caught yourself trying to figure out which two parts go together? You can write notes on the parts themselves until you're blue in the face, but no marking system beats stamping a number right on the joint, especially for complex job on dark wood. Most steel stamps are so tiny that they're not legible in wood, but these jumbo stamps work fine. When you get around to gluing your project, there'll be no doubt about which parts belong together. — *Ramon Moreno*

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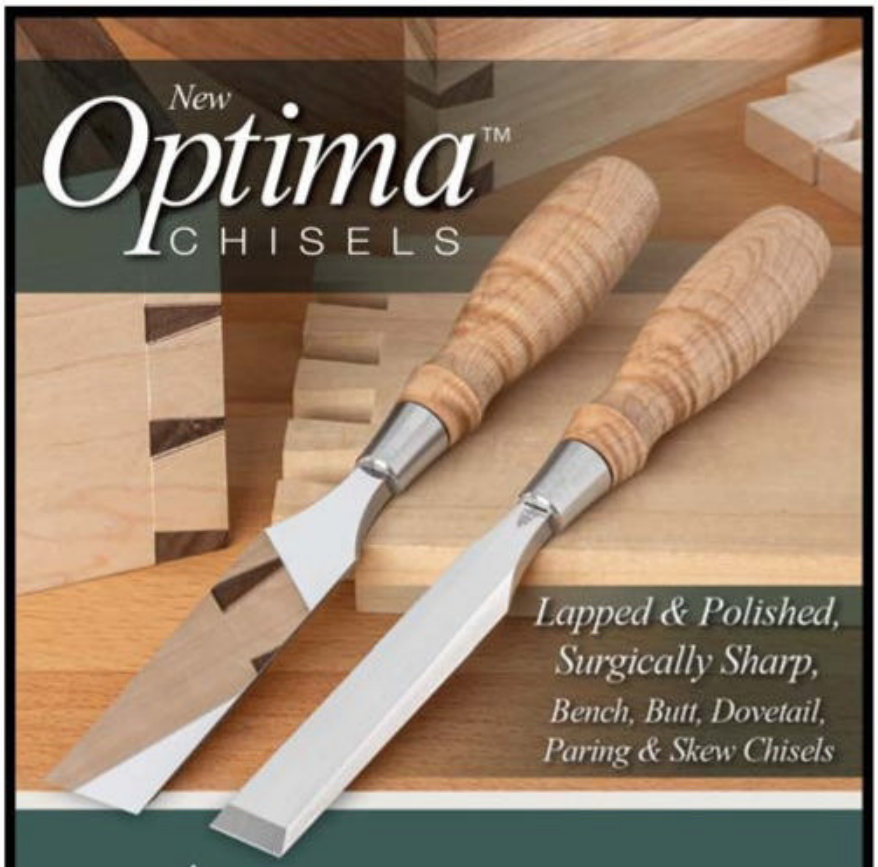

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Understanding Cordless Tools

Demystifying volts, amp hours, and types of cordless tool motors.

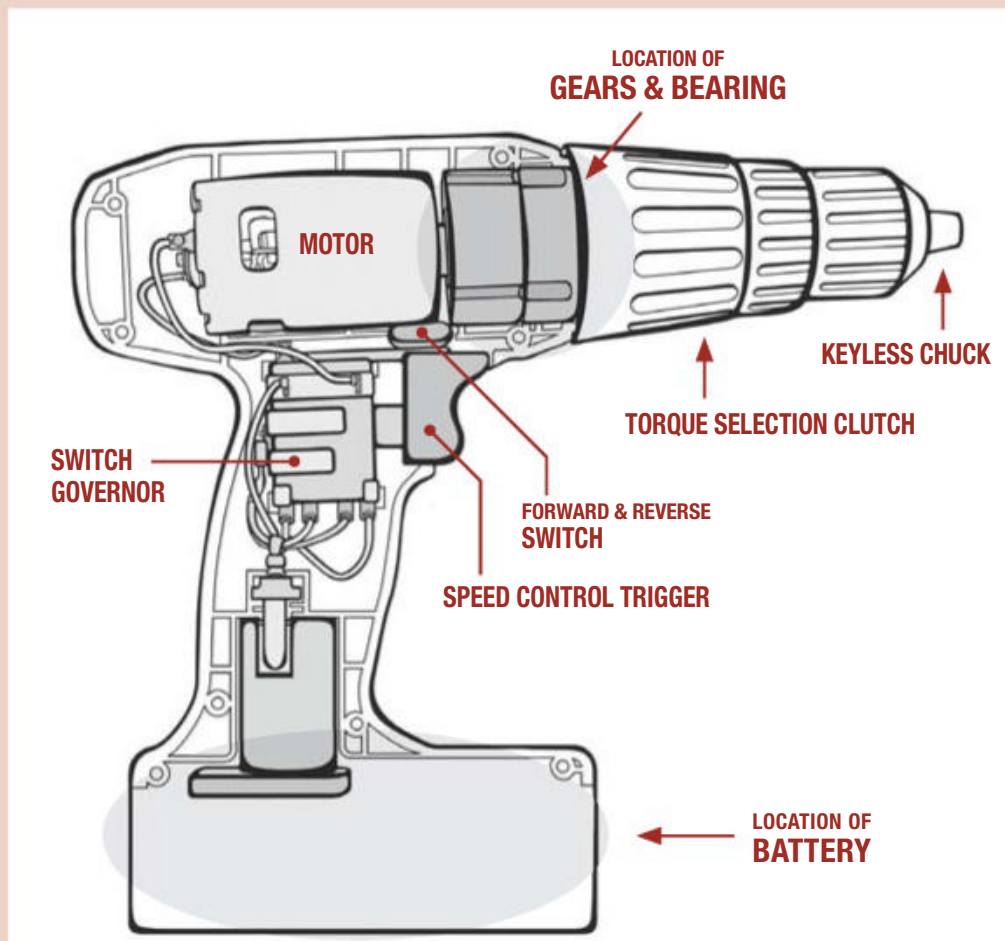
By Collin Knoff

More and more, cordless tools are becoming everyday fixtures in the woodworking shop. The most common of these is the drill, which you can see broken down to the right. Most cordless power tools have the same basic components, though, so once you understand how one tool works, you'll be well on your way to understanding them all.

Volts vs Amp-Hours

The two numbers that appear on the sides of most tool batteries are volts (V) and amp-hours (Ah). So what's the difference? If we were to use a car as an analogy, volts would be how much horsepower/torque your engine has, while amp-hours would be the size of the gas tank. (Before any battery engineers

Parts of a Drill



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write us letters explaining how inaccurate that is, remember we're a woodworking magazine, not a scientific publication.)

When comparing the different levels of voltage, it's important to remember that this reflects the peak available power, not the amount of power a tool is constantly using. That's why you don't see any normal drills with 40V batteries—all that power just adds unnecessary weight to the tool. It's also the reason a 12V drill can complete 90% of the tasks of an 18V one. So, when looking at the difference in voltage between tools, higher isn't always better.

Amp-hours is a term that is a bit more misunderstood in the world of batteries and battery health. Most people only look at the voltage a battery provides and completely ignore the other number next to it. However, the length of time a tool will run is often just as important as how much power it has. A 1.5Ah 20V battery is going to run out of juice much faster than a 3Ah 12V battery under normal usage. Not only does this interrupt your work, but it can also shorten the life of a battery (see **Battery Life Tips** on page 20). Amp-hours is especially important with tools that are constantly running, like a sander.

Types of Batteries

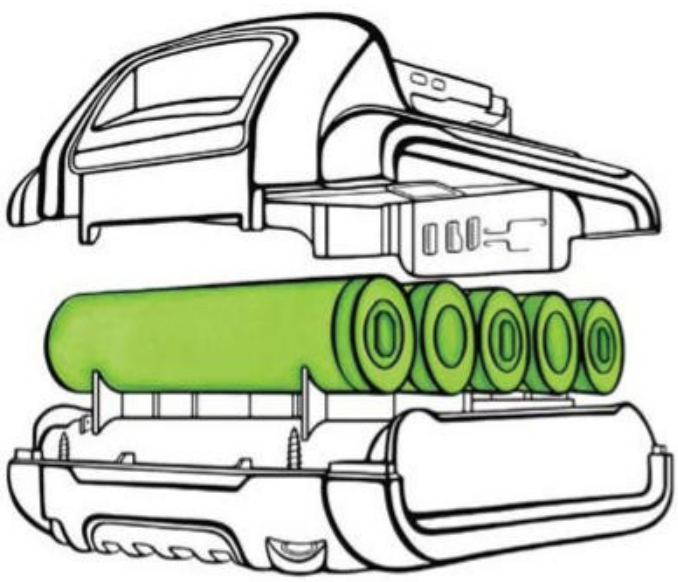
Historically, there have been two main families of batteries in power tools; nickel-based and lithium-based.

Nickel batteries all have nickel oxide hydroxide for the positive electrode and could be paired with cadmium (nickel-cadmium shorted to NiCad) or hydrogen (nickel-metal hydride or NiMH) on the negative electrode. Both NiCad and NiMH batteries have a fairly low power density and are susceptible to developing a "memory" if not discharged fully before each recharge. Up until only a few years ago, you could find tools with nickel-based batteries in discount or base tools lines, though they are all extinct at this point.

Lithium batteries feature a lithium compound for the positive electrode and graphite for the negative. Though the lithium compound may vary, they all share the same nomenclature of lithium-ion (Li-ion). Li-ion batteries have a very high energy density and have the ability to be recharged many times with minimal performance impact.

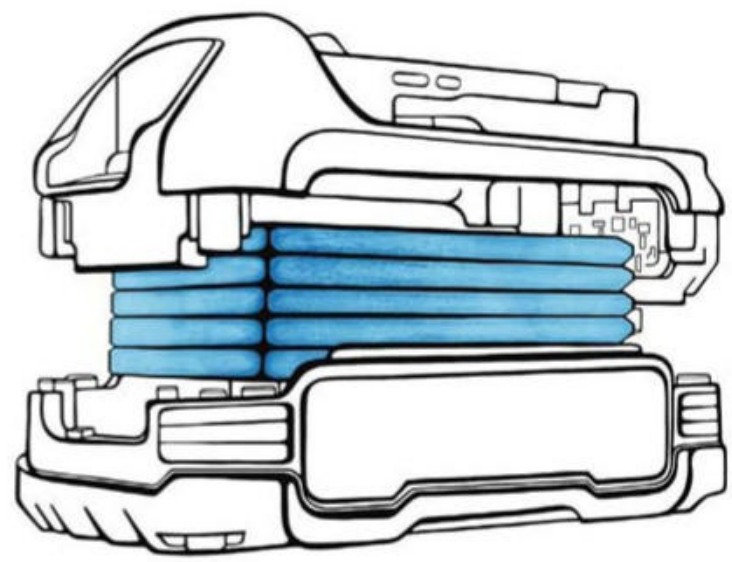
A very recent change has been occurring with the actual power structure of the batteries themselves. Traditionally, tool batteries, regardless of chemical makeup, are composed of individual power cells to determine voltage and amp-hours. These cells look a bit like a AA battery and are usually stacked horizontally within the battery pack.

However, *DeWalt* recently launched a new type of battery pack that uses flat cells stacked on top of each other. These cells, a bit more like the battery packs found in cell phones, are more space-efficient, which allows for greater Ah in a smaller package. *FLEX*, a German power tool company, has also announced the upcoming release of a flat-stack battery pack. It would not be surprising if more tool manufacturers start using this type of pack in the coming years to stay competitive.



Traditional Cell Battery

Cylindrical batteries are arranged inside of a plastic case. The number and type of cylinders determines the volts and amp-hours.



Flat Cell Battery

This new technology features flat battery packs that are more space efficient. This allows more amp-hours in a smaller, lighter package.

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W1877 13" BENCHTOP PLANER WITH SPIRAL-STYLE CUTTERHEAD

- Motor: 2 HP, 120V, single-phase, 15A
- Max cutting height: 6"
- Min. stock length: 8"

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W1870 18" VS SCROLL SAW WITH LED & ROTARY TOOL KIT

- Motor: 1/6 HP, 120V, single phase, 1.2A
- Max. cutting thickness: 2"
- Blade speed: Variable, 550-1600 SPM

⚠WARNING! †1

W1878 9" BENCHTOP BANDSAW

- Motor: 1/3 HP, 120V, single-phase, 2.8A
- Max. cutting height (resaw capacity): 3 5/8"
- Table tilt: 0–45°

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W1837 10" OPEN STAND HYBRID TABLE SAW

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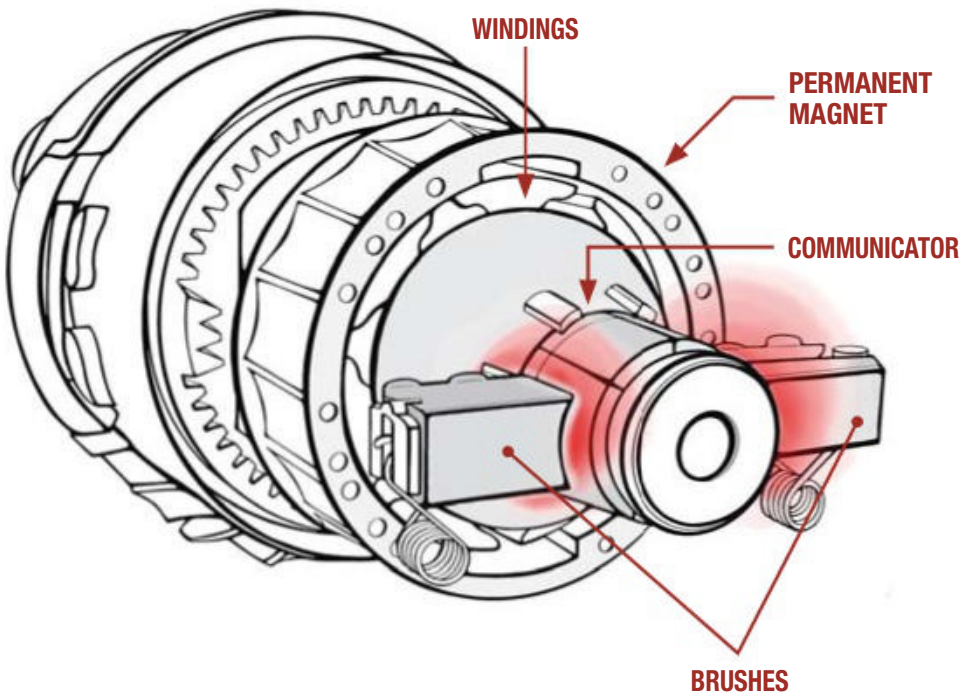
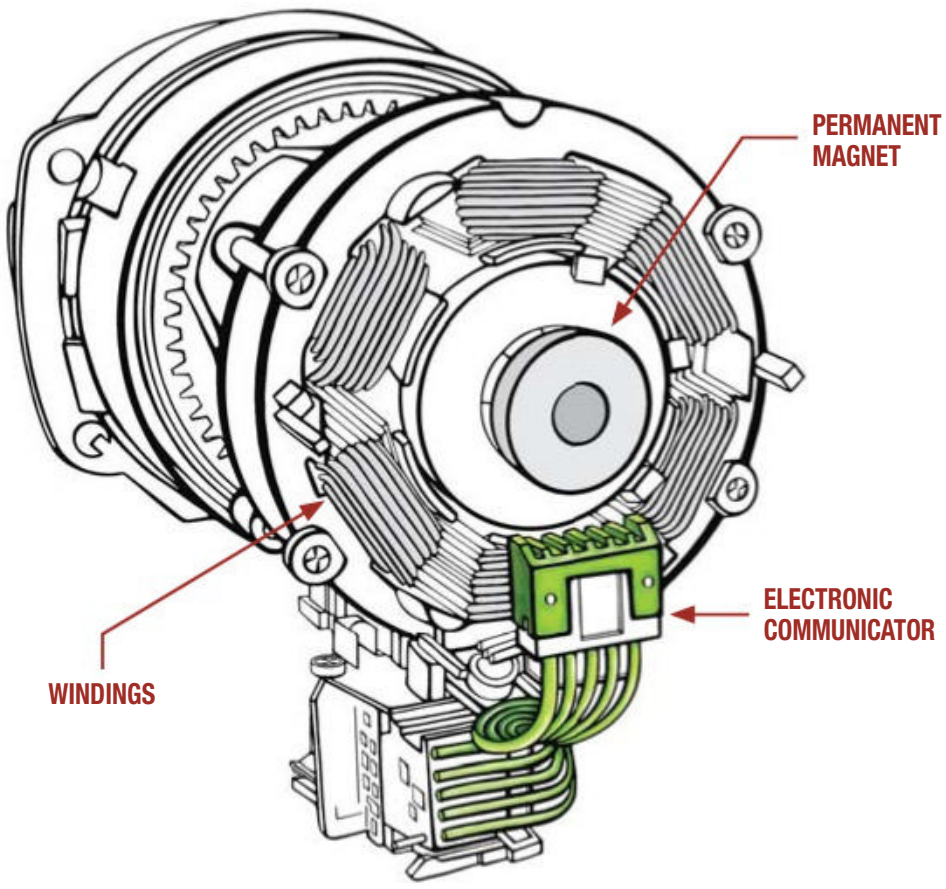


Brushed Motor

The contact between the brushes and communicator controls the power delivery for the motor. This sends current to the windings, turning them off and on to generate a rotating magnetic field.



Brushless Motor

The electronic communicator works in tandem with hall sensors to monitor the location of the windings and direct current accordingly to manage power delivery for the tool.

Types of Motors

The motor inside your tools is another area that has seen changes in recent years as well. Electric motors currently fall into two camps: brushed and brushless.

When a motor is turned on, it activates a magnetic field with the tool. This magnetic field creates rotation between the stationary and moving parts of the tool, causing the rotor to spin. The magnetic field needs to be constantly rotating to power the tool as it's used.

Brushed motors use mechanical timing to manage this rotation; the brushes (often made of graphite) send communication to magnetics within the motor. There are two types of magnets—permanent ones to provide a stationary magnet field and windings, which are actuated on and off to create propulsion. The brushes, which are stationary, send the signal to each winding coil whether it should be off or on. This continued attraction and repulsion is what actually causes the motor to spin. Brushed motors rely on constant contact between the brushes and the communicator, which means that as the brushes wear down with time, the motor will lose power and finally cease to function. You may also notice on older tools that you can see sparks within the tool as it runs—this is often a sign that brushes are starting to wear down.

Brushless motors also use permanent magnets and windings to create propulsion but utilize electric controllers and sensors to manage the magnetic field. This means that there are fewer moving parts and no brushes to wear down. The electronic controllers also opened up new design opportunities to improve the overall performance of the motor. That means that not only do brushless motors last longer, but they're also more powerful, efficient, and quieter than brushed motors. Plus, brushless tools tend to be much smaller than previous generations.

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So why doesn't every tool come with brushless motors? Right now, it's still a matter of cost. Most users don't need all of the bonuses of brushless motors and can get similar brushed tools for much cheaper. Costs have been falling, though, so don't be surprised if brushed motors go the way of nickel batteries by the end of the decade.

TOOL MAINTENANCE

You've probably noticed a theme as you've gone through this article—today's tools are more efficient and long-lasting than the tools of yesteryear. That doesn't mean you need to throw out your old tools or ignore all maintenance on new ones.

Keep or Not to Keep?

If your shop is filled with NiCad tools with brushed motors, fret not. Many high-quality brushed tools allow for easy brush replacement at regular intervals. Even if it doesn't, brushed motors can last a very long time under normal use.

Batteries are a bit more tricky—even the most carefully cared-for battery has a finite lifespan. It's technically possible to replace the cells in a NiCad or NiMH battery, but it's a task best left to professionals. A better option for most people is upgrading to Li-ion batteries for your old tools.

Some manufacturers make this easier than others—all 18V *Ryobi* tools can use any 18V *Ryobi* battery pack regardless of chemical composition. There are also adapters available to use that allow you to use newer batteries in old tools. *DeWalt* sells an official one that allows you to use their 20V Li-ion batteries in old 18V *DeWalt* Tools, but for other manufacturers, you'll need to look at third-party options. Take your time and do your research—the quality and tech can vary wildly, and if used incorrectly, you can damage your tools or batteries.

Heat is the Enemy!

The biggest enemy for all power tools is heat. The more power a motor must generate, the more heat it's also going to create. Electric motors rely on the rotation of the motor to move air through the tool and keep it cool. If the motor isn't moving fast enough, there won't be enough airflow, and heat will start to build up. Eventually, it will critically overheat and cause permanent damage. So how can you prevent that?

The obvious answer is to pay attention to your tools while using them—if the tool is struggling to complete the task, take frequent breaks or reassess your tool choice. Another way to make life easy on your tools is to make sure the blades and bits are sharp, clean, and the right kind for the job. A crosscut blade in your table saw is going to have a harder time ripping a long board than a dedicated ripping or combination blade (not to mention that it's more dangerous).

Regular Cleaning

This is another easy way to help extend tool life. It can be as simple as wiping off the sawdust when you're done using a tool for the day. Occasionally, it's a good idea to check and clean the vents on a tool (since heat is the enemy, of course). A toothbrush can remove gummed-up sawdust, and blowing compressed air into the vents while the tool is running will clear out internal debris. Saw blades and drill bits can be cleaned with a dedicated cleaner or an industrial degreaser. Removing the buildup on a blade can make it as good as new.

Most modern power tools don't need any lubrication. Any internal lubrication from the factory is specially formulated to last the life of the tool without breaking down. Occasionally chucks might require some lubrication if they start to stick. Don't just use anything off the shelf, though—consult your owner's manual or contact the manufacturer so you don't permanently damage the tool. **PW** – *Collin Knoff*

Battery Life Tips

HEAT MANAGEMENT When it comes to batteries, heat is the enemy. I often hear woodworkers talk about avoiding the cold, but batteries tend to be fine in below-freezing temps. In fact, they'll generally have no issues all the way down to -4° Fahrenheit. Heat is the real battery-killer, especially in the summer. Temperatures over 175° can cause permanent damage to the battery. That might seem high, but factors like being inside a hot trunk or sitting directly in the sun can cross that threshold easily. Keeping the battery cool will also extend run time and make the charging process more efficient.

CHARGE MANAGEMENT Pick a charger or charging mode that is applicable to your usage and run time needs. For example, if you'll be using the tool again soon, charge it all the way. If it's going to be a while until it's used again, 50% is the target you should shot for, then fully charge it right before use.

USE CASE Pick the proper battery for the application and power tool you're using. Don't choose a lower power battery like a 2.0Ah or 4.0Ah for a high-use tool, as this will require frequent charging and decrease the life span of a battery.

What should you do with a dead battery or Tool?

Even with their longer lifespans, modern tools and batteries will eventually wear out. Proper disposal techniques will keep toxic materials out of landfills and allow the valuable lithium to be recycled. To find a recycling center in your area, check out www.Call2Recycle.org.

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Drum Style Box with Pewter Insert

PROJECT #2211

Skill Level: Intermediate

Time: 4 Hours

Cost: $30

A textured pewter inlay elevates this elegant box to something that you'll be proud to display.

By Jimmy Clewes

PHOTOS BY LOGAN WITTMER AND JACK COYIER

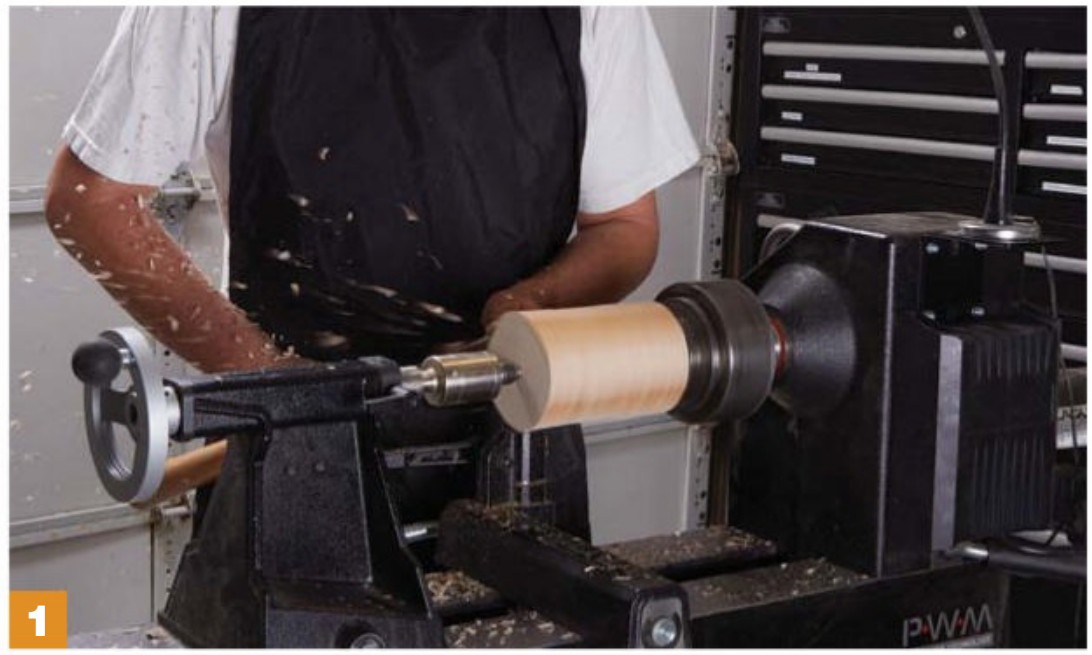
Interested in the novelty of melting, casting, and texturing pewter? With this turned drum style box, I'll show you how to make a beautiful enhancement to any woodturning or woodworking project.

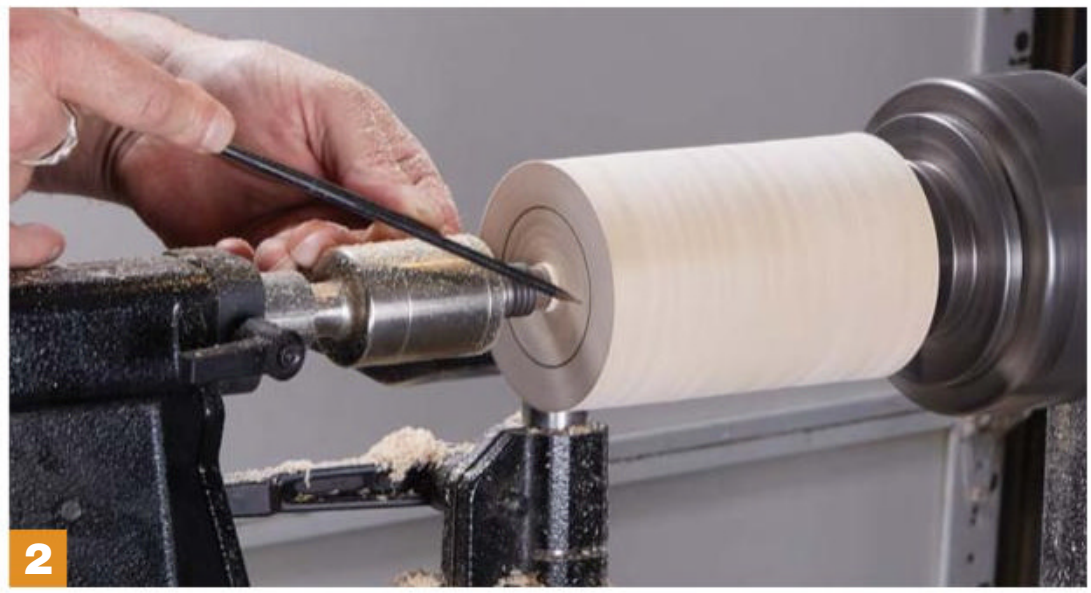
Begin with a blank of wood that is 6" long and 3" square. I chose a rippled maple blank, often referred to as curly maple. Find the center of one end by marking a couple of lines on each end, from corner to corner. Then I use a center punch to pop an indent in the middle where the drive and revolving center will be located. I prefer to use the *Sorby* Stebb center or a similar drive from *PSI Industries* to mount the square and a revolving ring and point center in the tailstock.

Prepare and Separate the Blank

First, I use a spindle roughing gouge to turn the box blank from square to round. Next, I use a pair of dividers to set the diameter of the tenons. There will be a tenon turned on each end of the blank to fit the chuck jaws. After marking, I use a parting tool to cut each tenon to the correct size.

Now, we must divide the blank into thirds. One-third, the lid, is cut from the blank. I prefer to use a band saw to do this with the use of a "v" block to hold the piece securely and safely. Cutting it this way, I only lose the width of the band saw blade, which is about an 1/16". If it parted it off, I would lose an 1/8". This smaller waste allows for a much better grain match between the lid and the base.





1 Use a spindle roughing gouge to turn the square blank round. True up the end grain of the blank with a parting tool.

2 Set dividers to match your chuck jaws. Scribe a line on the end grain of the blank.

3 A couple of light cuts with the parting tool will form the tenon on the end of the blank. Use a spindle gouge or specialty ground parting tool to form the dovetail shape of the tenon.

4 Divide the blank into thirds and mark the lid section with a line.

Turn the Inside of the Lid

I set aside the base and mount the lid in the chuck, holding onto the tenon I just turned. Using the 1/8" parting tool again, I true the face for the first third of the lid's diameter. There is no point in going all the way to the middle, as you are going to be hollowing it out anyway.

Now, we need to decide how thick the wall of the lid will be. I use a pencil to mark a target and cut into the face of the lid about 1/8" to establish the wall thickness. Make sure that the cut is square and not tapered either way, or the lid will not fit correctly.

At this point, I need to determine how deep to hollow the lid. I don't see any need for a lid to ever be hollowed too deeply unless something within the design requires it. In this instance, I will need to allow for a pewter insert which is about 1/16"-thick when finished.

There are various techniques for hollowing boxes. In this case, I chose to use the *Mega Mate* carbide hollowing tool. This tool has a cup cutter which has a sharp cutting edge. Unlike other carbide tools, it cuts — it doesn't scrape. It's a very forgiving tool, cuts beautifully, and has a very small learning curve. Depending on the wood, I may also use a micro bevel bowl gouge for a finishing cut. For this box, I will hollow the lid with a slight curve on the inside, which is far easier to sand than a flat bottom.

After hollowing, I sand and finish the inside using a lightly thinned down shellac. It's a mixture of 75% *Zinsser's* clear coat shellac and 25% denatured alcohol. After the shellac is dry, I use a 0000 *Scotch-Brite* type of abrasive to lightly cut it back and then apply a light coat of Danish oil with the excess wiped away after a few minutes. This should leave a silky-smooth finish.

5

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5 After making a light truing cut, mark the lid's wall thickness.

6 Use a parting tool to define the interior of the lid.

7 The Mega Mate hollowing tool is a quick and easy way to hollow the lid.

8 A finish cut can be made with a micro-bevel bowl gouge.

9 Add any detail you'd like. Here, I add a few lines with a point tool.

10 Sand and finish the inside of the lid.

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Preparation for the Pewter Insert

With the inside of the box lid finished, the next step is to mark the outside of the blank where you have hollowed the inside to. I add an extra 3/8" for the pewter insert. Using your 1/8" parting tool, separate the lid box from the tenon. Remember to open up the cut slightly as the parting tool may bind as it has no clearance. With experience, you can slow the speed on the lathe down and catch the lid as you part it off. Alternatively, you can part the lid most of the way and then use a saw to cut the lid from the remaining waste wood.

The next step is to prepare a wood mold for the pewter insert. I begin by turning a blank with a tenon and place it in the chuck. Next, I square off the face and then use my parting tool to turn a 1/8" deep recess with a flat base in which to pour the molten pewter. Leave the mold in place, but remove the chuck to place it in position to pour the pewter.

Stop, Pewter Time

For the pewter insert, I am using Britannia Pewter, which I bought off *Amazon* and does not contain lead. It contains 92% Tin, 7.5% Antimony, and 0.5% Copper, which has a melting point of 563° and a pouring temperature of 650°. Since the melting point of the pewter is fairly low, I can use a propane torch to melt the pewter in a ladle. For my ladle,

I am using a cast iron castling ladle that belonged to my wife's father for casting fishing weights and lures. Newer versions are available online.

Now, guesstimate the amount of pewter you'll need to melt to fill the mold recess. Place it into the ladle and begin to heat it to the correct pouring temperature. A good indication it's ready is when the pewter appears to be a very fluid "blob."

Next, pour the pewter into the mold. Just don't pour too fast; just a steady flow is fine. The pewter will stay molten and fluid in the mold for at least a minute. If necessary, tap the chuck to fill any voids or air gaps created when pouring. If there isn't enough pewter after the first pour, just wait for it to cool and re-melt. Just make sure to add enough pewter to fill the recess on the second try. Leave it for several minutes to cool down before handling. When cool, you should be able to just tap the mold and the pewter insert will drop out. Place the pewter insert back into the mold using a medium viscosity CA glue. I like to use an accelerator on the pewter before placing it on top of the glue to give it an instant bond.

11 Part the lid off the tenon, leaving a little room for the pewter insert.

12 Use a parting tool to create a recess to pour the pewter into.

13-14 Heat the pewter up and, when it's melted, pour it into the mold, allowing it to cool.

Turning of the Pewter

The chuck and mold can now be remounted on the lathe, and the turning of the pewter can begin! With sharp tools, the pewter turns very easily, and it's a delight to see those fine silver strands peeling away from the main disc.

First, I use the bottom wing of a long grind bowl gouge to gently shape the pewter to form a soft curve on the top. A scraper can also be used. Next, I use a *Sorby* texturing tool to give what will be a unique texture and pattern. With texturing tools, it's almost impossible to repeat the same pattern every time as it depends on the speed of the lathe and the speed at which you trail the tool over the surface. If you don't get the pattern you want on the first try, you can just make another cut and try again. The thickness of the insert will dictate how many attempts you have. I also used a point tool to make a small v-cut to define certain parts of the texturing.

After texturing the insert, make a square cut with the parting tool to clean up the edge of the insert. Then make another square cut just behind the insert to part it from the waste wood mold. You may find that you only need to reveal about 1/8" of the wood behind the insert and then with a light tap to pop it off the glue.

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15 The soft pewter is easy to cut with sharp tools.

16 The fresh-cut surface if the pewter is the best surface you'll get — no sanding the pewter!

17 Add texture with a texture tool.

18 A light cut will create a clean frame around the textured area.

19 As you can see, the fresh-cut pewter glistens.

20-21 True up the outside of the inlay, then part the pewter off the mold.

22 The pewter shavings can be collected and remelted for next time.

On to the Box

Now it's time to set the lid aside and go back to the box blank. With your base in the chuck, square up the face just as one did with the lid. This will allow for a clearer scribed line for fitting the lid. Using the dividers, measure slightly more than the opening on the lid and scribe the line. With the parting tool, cut to the line. The box lid should not fit yet as the joint is still too large. It's now that we sneak up on it by removing hair-like shavings until the lid is a snug fit. This tight fit will allow us to turn the recess for the pewter. In essence, the base of the box has just become a jam chuck for the lid. If you over cut and it isn't snug enough on the base, don't worry. You can always expand the jaws to hold the lid from the inside and cut the recess

23 Clean up the end grain of the box where the lid and box body will meet.

24-25 Mark a tenon that is slightly larger than the mortise that is inside the lid of the box. Sneak up on the fit until the lid just barely slips on.

26-27 Now, spread a little water on the tenon and slip the lid in place. This temporary swelling of fibers will lock the lid to the base so we can turn the outside shape. Once the water evaporates, you'll once again be left with your original perfect fit.

that way. Just don't grip it too tightly, or you may hear that irritating/annoying splitting noise!

With the lid snug on the base, I start to shape the outside of the box. The outside shape is the guide when I begin to hollow the inside, which helps me achieve an even thickness.

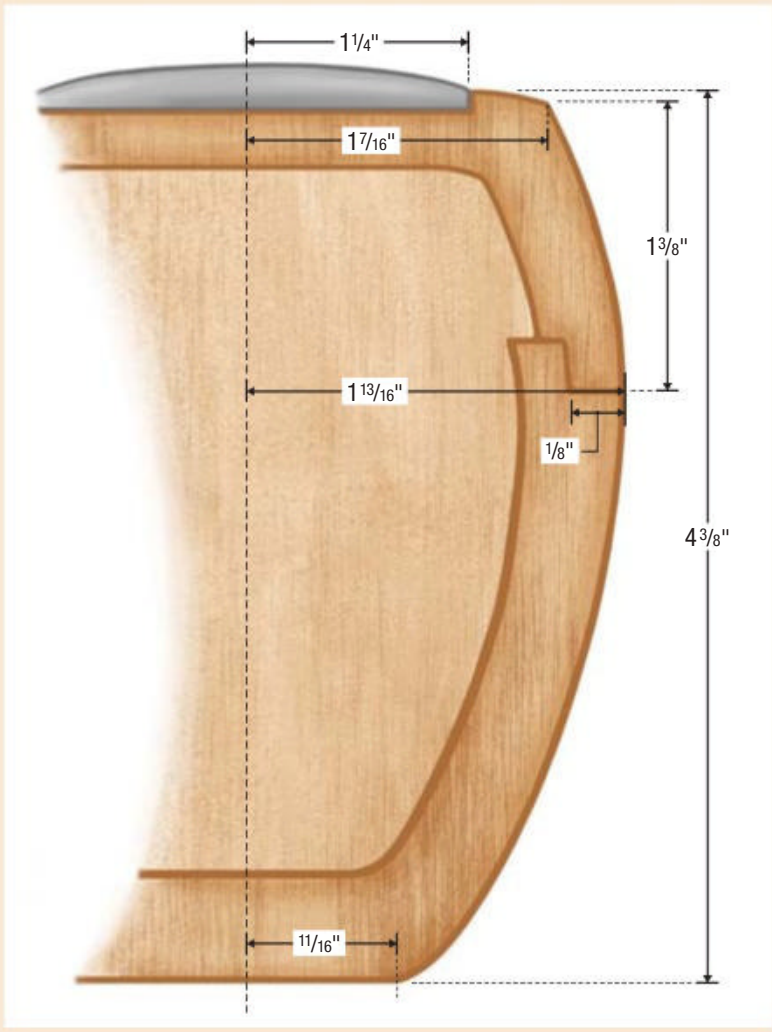
After the initial shaping, I measure and scribe a line with the dividers to mark where I want to hollow for the pewter insert. Measure just less than the diameter of the insert and cut out the recess. Open up the recess with the parting tool until the pewter insert just drops in. Remember, it's easier to remove wood than put it back! My recess is 1/16"-deep, but just match it to the thickness of your insert. With the pewter insert completed and fitting into the lid, we can set it aside and continue with the box. The insert will be glued in when the box is totally finished.

28 Use a bowl gouge to shape the outside of the box. With an end grain orientation like this, cut from the largest diameter to the smallest.

29 Rough in the shape, as the outside will designate the interior shape.

30 Get a good clean surface on the top of the box using a bowl gouge.

Drum Style Box



31 Measure and scribe a line that matches your pewter insert.

32 Use a parting tool to step away the waste.

33 Sneaking up on the cut will allow for a perfect fit.

Hollow the Base

The shaping on the outside of the box is complete, and the hollowing can begin. Using a parting tool, I make a cut and leave approximately 1/8" of wood for the thickness of the joint. Then I hollow the base in exactly the same way as the lid.

After hollowing, sand and finish the base. We can now fit the lid to the base to sand and finish the outside of the box. If the lid fit's just a little too tight, a light coat of paste wax on the joint will ease the fit.

Finishing

After finishing, the base can be parted from the waste wood left in the chuck. First, reverse the waste wood and hold it gently on the

34-35 As with the lid, set the wall thickness using the parting tool. Once that is defined, you can switch to a bowl gouge, or in my case the Mega Mate.

36 Hollow down to the inside of the box. Follow the outside shape of the box to achieve that coveted light, even wall thickness.

Drum Style Box

37 Hold onto the tenon on the base and finish shaping the base of the box.

38 Remove the tailstock and slightly hollow the base. A couple of lines around the base and bottom add some nice detail.

39 Sand and finish the box.

40-41 Use a medium viscosity CA glue in the recess of the lid. Apply accelerator to the bottom of the pewter before pressing it into place on the box.

joint, being careful not the crush it. A jam chuck is another option if you are too nervous about holding it by the joint. To part the base, bring up the revolving center in the tailstock for extra support and gently pair the wood away until you have a concave curve in the base. Remove the tailstock revolving center support and very gently remove the small waste piece of wood left in the center. When this is removed, you can sand and finish the bottom of the box. Now, all that is left to do is glue in the insert using medium super glue and an accelerator.

PW — *Jimmy Clewes*

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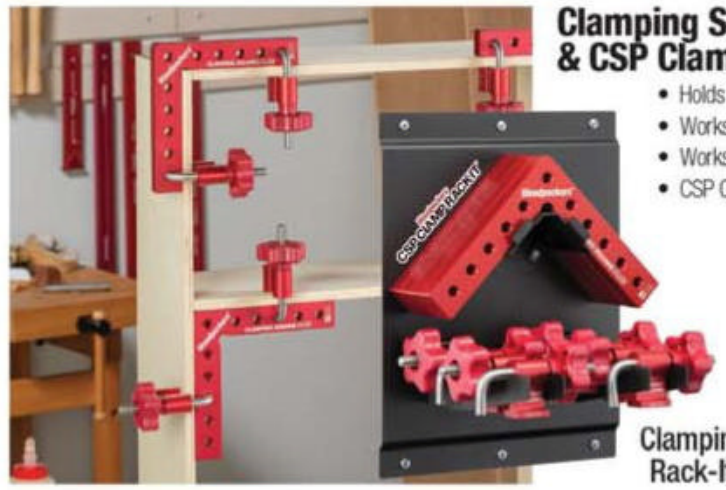

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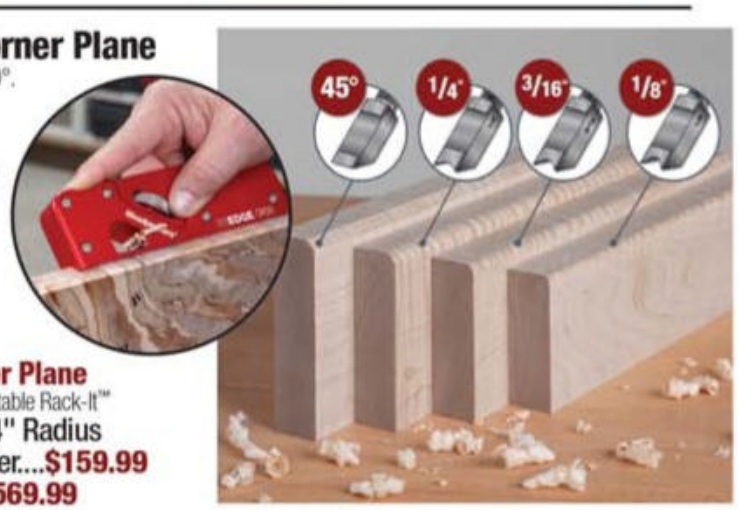

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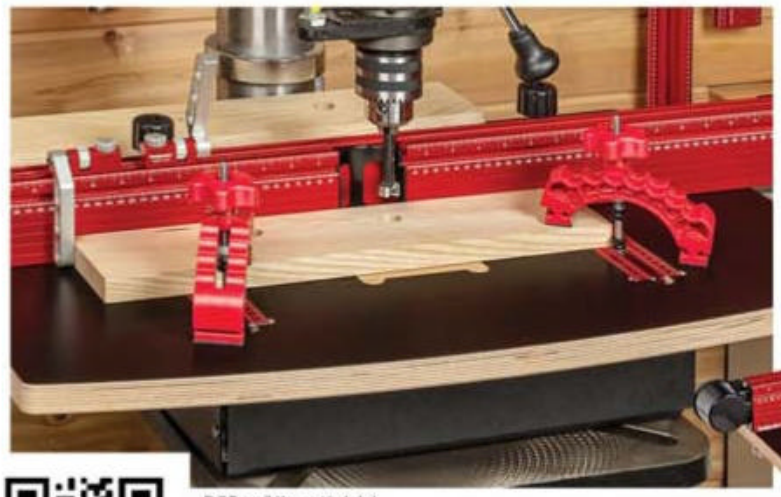

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PROJECT #2212
Skill Level: Intermediate
Time: 2 days
Cost: $125

Limbert Style #239 Tabouret Side Table

This side table, designed by Charles Limbert in the early 1900's, features an octagon top, Arts and Crafts details, and traditional construction methods. **By Willie Sandry**

PHOTOS BY THE AUTHOR

Attending antique furniture shows and pouring over Charles Limbert and Gustav Stickley catalogs are favorite activities in my household. I love to see antique pieces from the early 1900s, but when they're not available, a picture or a catalog will have to do. From the pieces I've measured in person, I learned Limbert favored a 5° slope on many of his angled tables and desks. The proportions are still fresh and inviting more than a hundred years after this table was originally designed. In fact, with many of Limbert's tables and chairs, I'm amazed at how they pair with other styles. With interesting cutouts, angled panels, graceful corbels, and an octagon top, this interesting little tabouret is equally at home with craftsman bungalow style or modern decor.

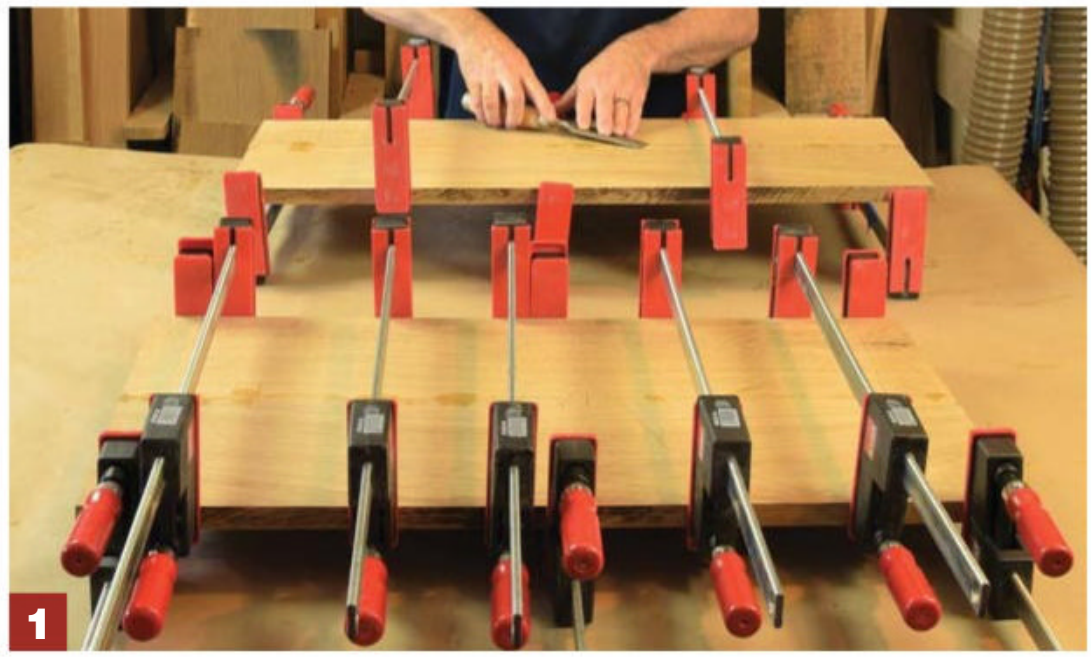
Start with Panel Glue-ups

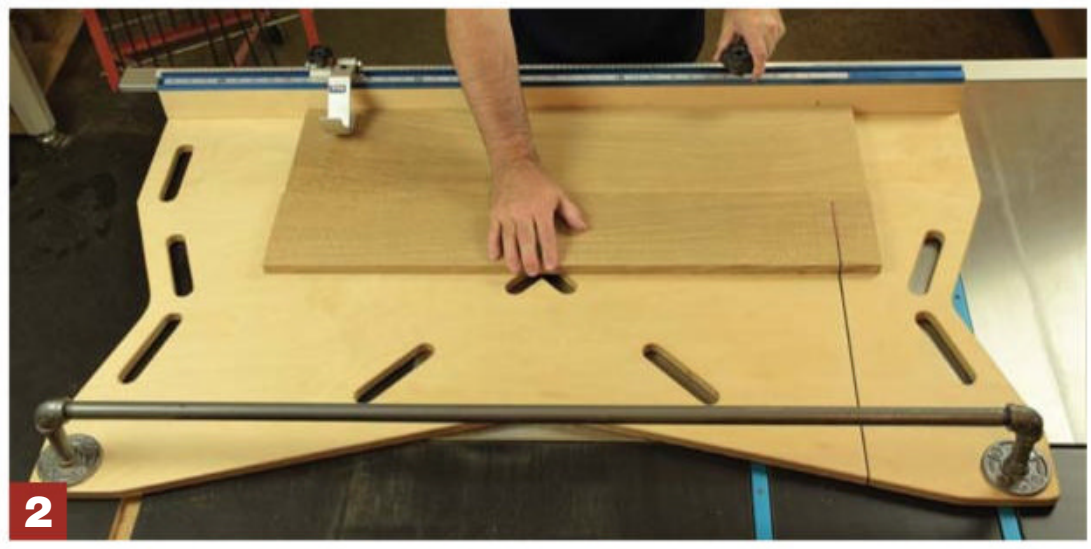
Like much of Limbert's furniture, the #239 tabouret is built with solid panels rather than four legs. That turns out to be an advantage in this case because it simplified construction. If a side table such as this were, in fact, built with four legs, it would necessitate compound angles. By contrast, four panels angled inward only require simple angles, with no compound angle to contend with. Prepare the four side panels as well as a panel for the top. Make these panels slightly oversized for now and then set them aside to dry. While a combination blade is still on the table saw, take a moment to cut blanks for the four corbels.

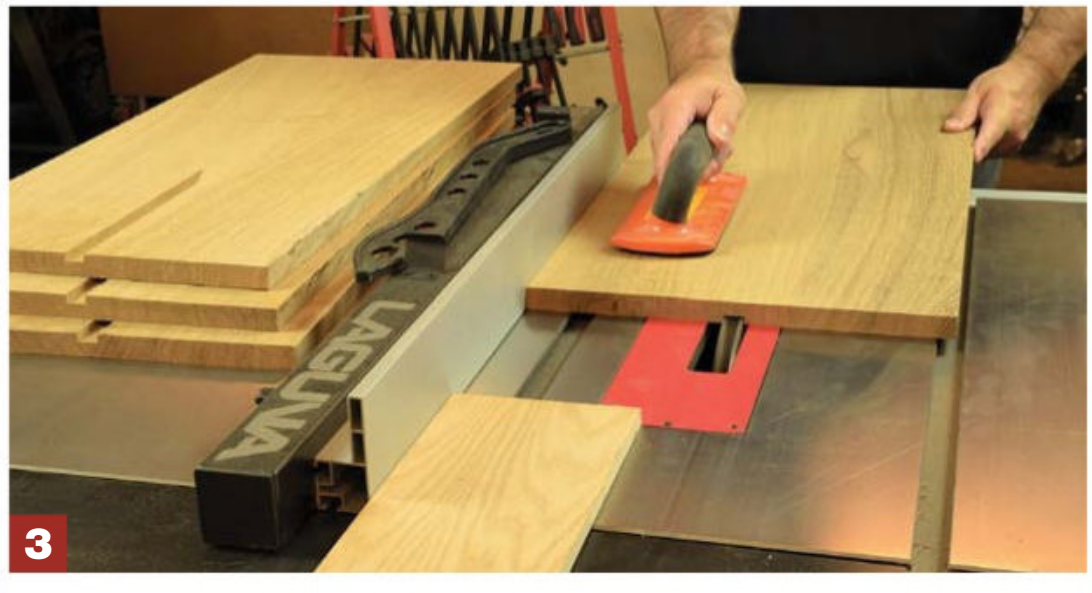
Once the side panels have been trimmed to their rectangular size, the panel's top and bottom should be beveled to a 5° angle. However, we don't want to add the bevel to the panels yet, as we'll want to take care of some joinery for the corbels first.

Corbel Conundrum

At this point in the process, I like to remember one of my favorite sayings in woodworking, which goes,







1 Mill and glue the side panels and the top. Clean up excess glue with a chisel.

2 A large crosscut sled such as this "X-Cut" sled comes in handy to first square one end, then trim to rough length.

3 Install a 5/8" wide dado stack and adjust the rip fence to center the groove in your panels. Note the strip of the plywood clamped to the outfeed table to limit the groove length of 9".

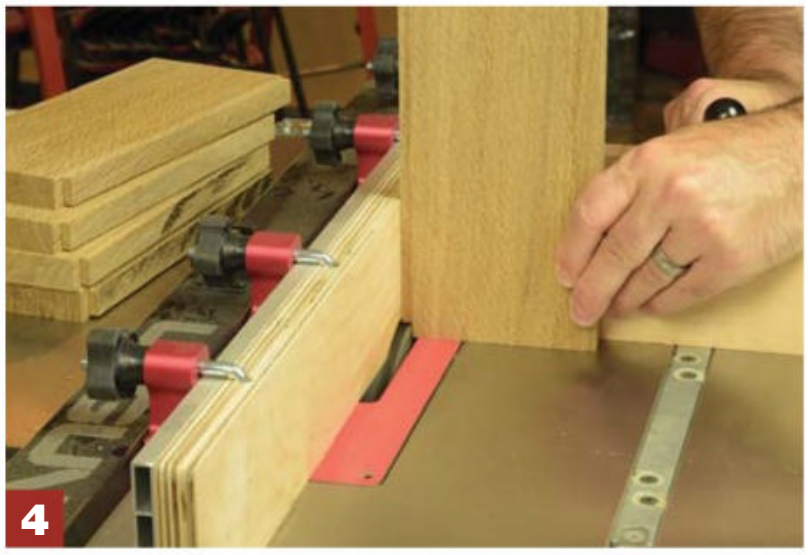
"joinery before curves." This simple mantra will save you time and energy in the workshop, and it applies to nearly any project. For the tabouret table, this means we should cut a groove for the corbel before we angle the side panels. My preferred method is to cut this 9" long by 5/8" shallow groove with a dado blade. Set up a 5/8" wide dado stack on your table saw and set the blade height to 1/4". A stop block clamped to the outfeed table ensures the groove will be the correct length. An alternative method is to use a router and edge guide, but either way, you'll have a little work to do with a chisel to square up the groove.

With the dado blade still installed, add a sacrificial fence to your table saw and form a tongue on the corbels. The tongue is just a three-sided tenon, and you'll incrementally raise the blade height until the corbel fits into the groove. Once this joinery is complete, we need to go back and add the 5° angle to the top and bottom of the side panels. Make this light trimming pass at the table saw with a riving knife installed and use firm pressure with a push-paddle to control the cut.

Layout the curved line of the corbel and shape them at the bandsaw. While at the bandsaw, trim the angled shape of the side panels. Stay just outside your line—but don't worry about a perfect cut. We'll flush-trim the side panels to the master template later.

4 With a dado blade and sacrificial fence installed on the table saw, mill a stub tenon on one edge of the corbel blank. Then raise the blade to 1/4" and turn the corbel on end to remove the end of the stub tenon. Guide this cut with a miter gauge and sacrificial fence.

5 Bevel the top and bottom of the side panels. Set your blade to a 5° angle. Adjust the rip fence for a 27 1/2" cut and bevel one end of each panel. Reset the fence for a 27 1/4" cut and flip the panel end-for-end to make the second bevel cut. Make sure to install the riving knife on your saw and use firm pressure with the push paddle to control this light skimming cut.



6 Make the long-tapered cuts at the bandsaw. Save the offcuts because they will be handy during final assembly.

7 Using carpet tape, secure the 1/2" thick strips of MDF that create the template mock-up to the template MDF. These strips will guide a router to rout the cutouts.

Template Time

The side panels are a great case for template routing. The lifted shape at the bottom of the panels, as well as the piercings and angled sides, can be handled with a single template. You might imagine that cutting the template itself with a jigsaw would involve hours of filing and sanding, but luckily there's a better way.

Start by cutting a 1/2" thick piece of MDF to the rough dimensions of the side panels. This will become the template. Using additional strips of the MDF, layout the shapes and angles of the side panels as seen in the detail renderings on page 40 to help guide a router. Temporarily attach these strips to the template board with double-sided carpet tape.

The cutouts of the template will be removed with a three-step routing process. First, make a rough cut with a 1/4" spiral bit and a 7/16" guide bushing. This will remove the trapezoid shapes and lifted shapes from the template. Then switch to a large diameter flush trimming bit to remove the ledge left from the first step. The large diameter bit leaves a very smooth surface but won't get into tight corners. To clean out those corners, flip the template over and clean out the corners with a small diameter flush trimming bit with bearing on the tip.

8 To rout the cutouts on the side panels, use the following three-step process.

9 Rout the panel openings. Use the same three-step routing process to rough out the openings and trim them flush with a template shape. A large diameter bearing guided bit can be used to flush trim the long-tapered sides.

Now for the Real Deal

Now, we'll use the template to shape the oak side panels using the same three-step process described above. I use this technique quite often, and it makes me feel like I'm using a router "like a jigsaw."

The third and final step of removing the corners is optional, but I feel it makes Arts & Crafts style furniture more authentic. While keeping the template clamped to the workpiece, flip the whole assembly over and use a small diameter bearing guided bit. I often use a 1/4" spiral bit with bearing on the tip. The end result is crisp, accurate cutouts that require very little sanding.

Locking Miter Joints... Woodworking Magic?

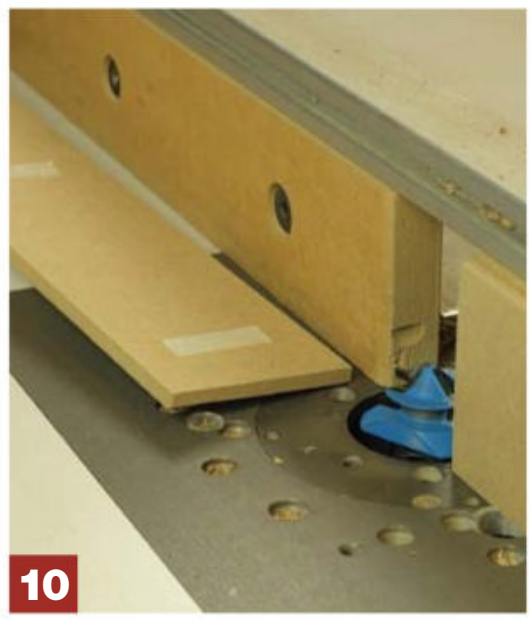
There are just a few processes in woodworking that feel like pure sorcery. Perfect machine-cut dovetails on a router jig. Tight fitting inlays with an inlay bushing kit. That's how I feel whenever I get the chance to use a locking miter joint. It's such an improvement over simple mitered corners that I can never go back.

That said, there are a couple of key steps to getting great results with a locking miter bit at the router table. Attaching strips of MDF to your workpiece helps to protect the delicate knife-edge formed by the bit. This also gives an additional bearing surface against the router table for consistent results. The other key—cut locking miter joints in two passes. Some woodworkers feel this type of joint must be cut in a single pass, but that's simply not true. In fact, all it takes is a strip of 1/4" thick MDF carpet taped to the router table fence.

Simply make your first pass with the spacer strips in place and remove them before making the second pass. One final point for locking miter joints is how you orient the joint on the board. If you rout both edges of a side panel the same way and both edges of the adjacent panel the opposite way, it will make the clamping process go a little easier. For instance, you'll rout both edges on two of the four side panels against the router table. The other two side panels will be routed vertically against the fence of the router table. This will ensure you only have to clamp the joint in one direction. For a quick video demonstration of these locking miter tips, check out "The Thoughtful Woodworker" on YouTube.

Dry Run

Once the locking miter joints are complete, bring the panels together to see how everything fits. If you're satisfied with the long corner joints


10

10 Set the bit height and fence position on your router table. Add a strip of 1/4" MDF to the fence and temporarily attach it with carpet tape.

11 Make the first pass on two of the four side panels with the panel flat on the table.

12 Then make the first pass on the other two side panels with the panels vertically against the fence. It's important that the profile on the left and right edges of the panels are the same because it simplifies the glue-up process.

11

12

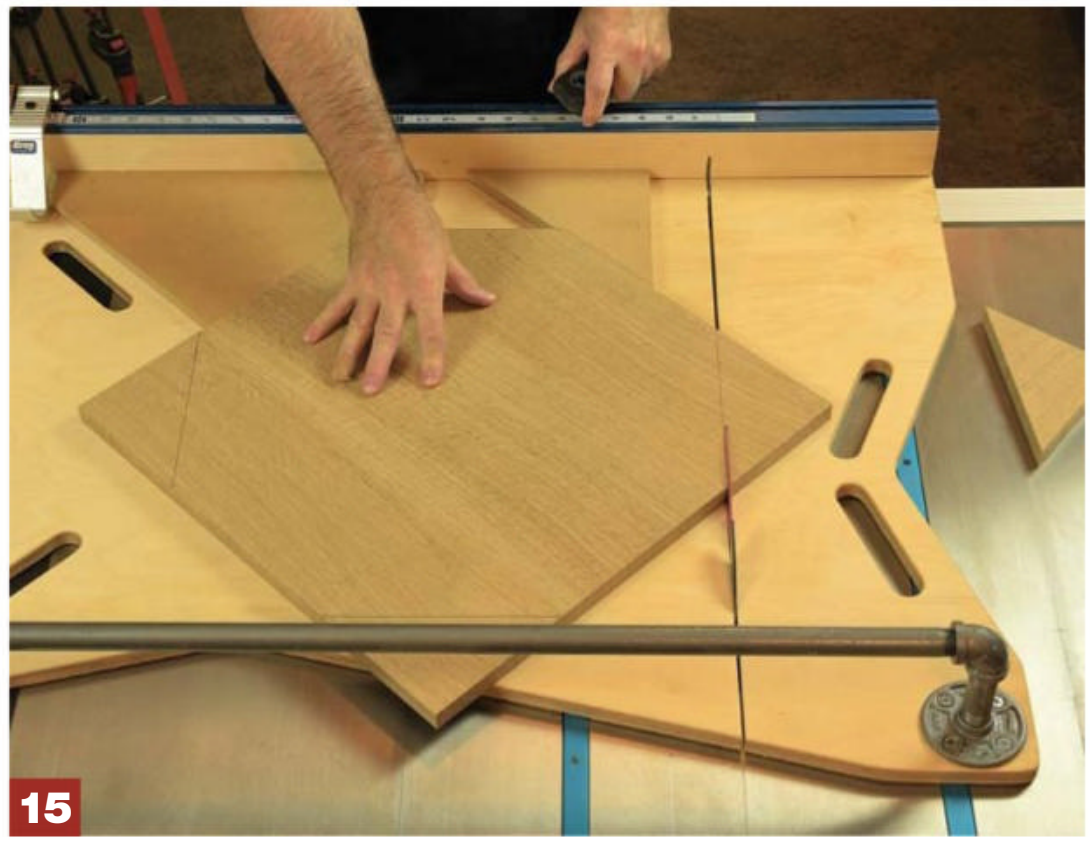
13-14 Now for the easy second pass. First remove the 1/4" MDF strips from the router fence to make a full-depth cut. Add strips of 1/2" MDF along both edges of the panel to help protect the knife-edge formed by the locking bit and to nearly eliminate tear-out.

15 I discovered a quick and easy method to trim the octagon top on a crosscut sled. Affix 45° scraps to the sled to form a cradle for the top panel. Now just trim one corner off the panel, rotate, and repeat.

of the table, go ahead and test the corbels. They need to be trimmed to fit against the underside of the octagon top. Install the corbels and mark a line with a long straight-edge. From there, it's just a matter of cutting to your line at the miter saw.

Octagon Top

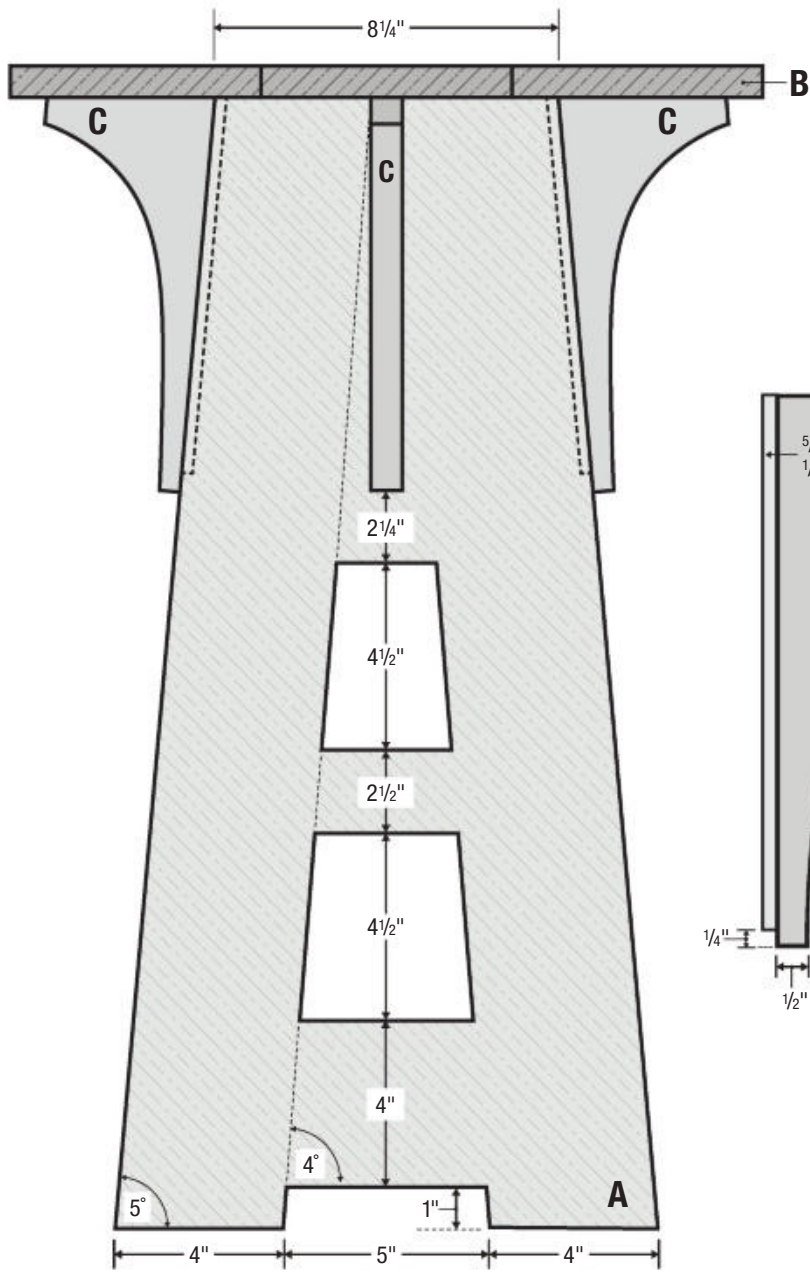
Fetch the top panel you made previously and set about trimming it to 18" square. From there, you can decide the easiest way to trim the square into an octagon shape. In my shape, that turned out to be a large crosscut sled that I've nicknamed the "X-Cut Sled." Use scraps of sheet goods at a 45° angle and temporarily attach them to the sled with carpet tape. This forms a perfect cradle for the square top. An adjustable stop on the sled offers additional support as you push the sled past the blade. Now simply rotate the panel and repeat the process until you've knocked off all the corners.

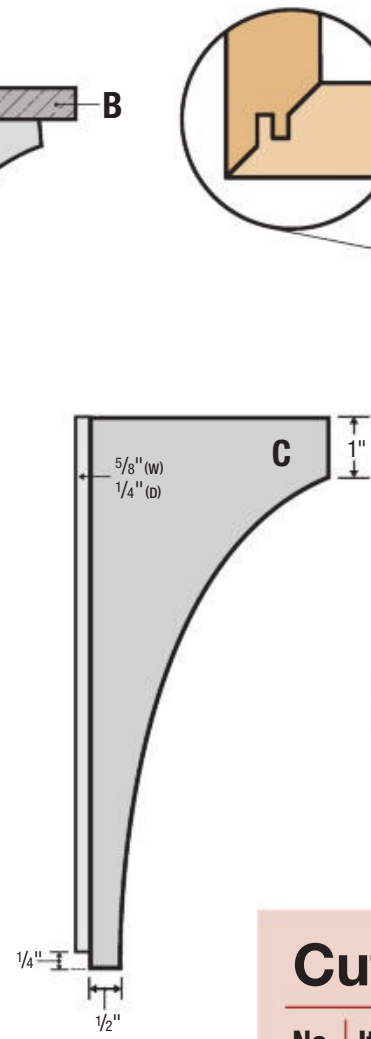


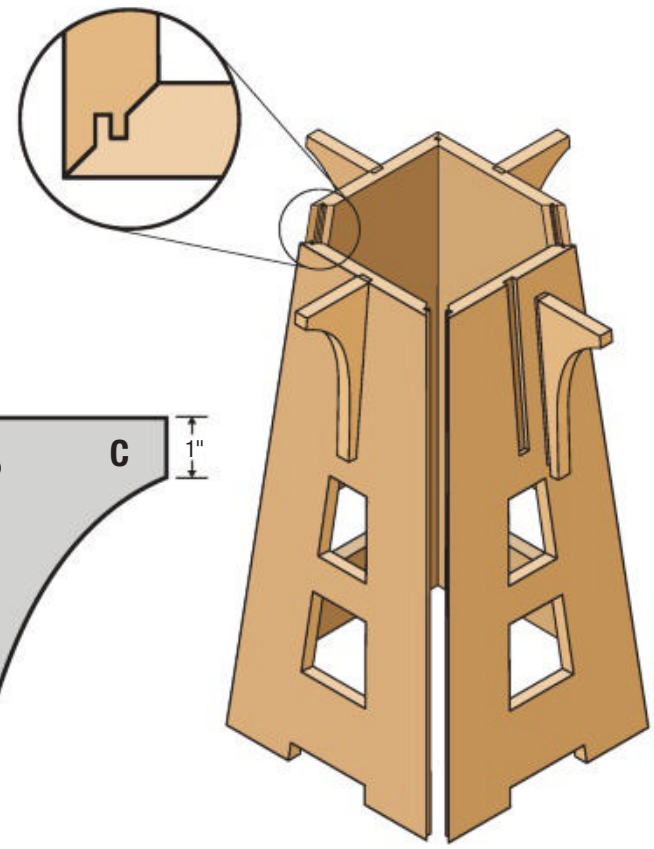
Some Details Before Gluing the Table

Take your time with surface prep and final details before you do the final assembly. Ease the edges where appropriate with a 1/8" roundover bit. All of the openings in the panels and the lifted shape at the bottom will benefit from softened edges. Likewise, round over the exposed edges of the corbels and top panel. Sand the parts through your normal grits, which for me is just 120 and 150 grit sandpaper. Anything finer than that can be hand sanded after the table is assembled.

Limbert No. 239



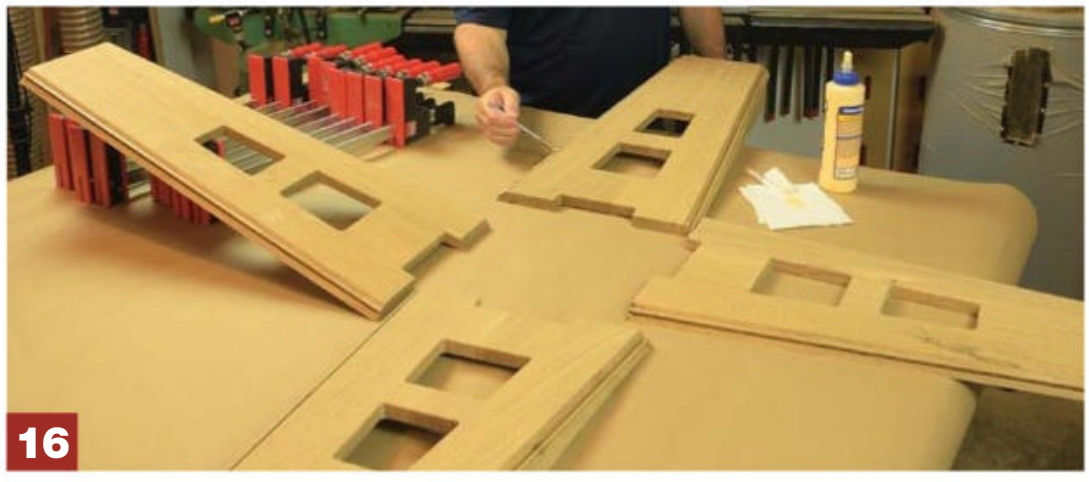




Cut List

No.	Items		Dimensions (in.) T	W	L
4	**A**	Side panels	¾	13	27½
1	**B**	Octagon top	¾	18	18
4	**C**	Corbels	¾	4¼	9¼

Plus ¼" and ½" thick MDF for the various templates.

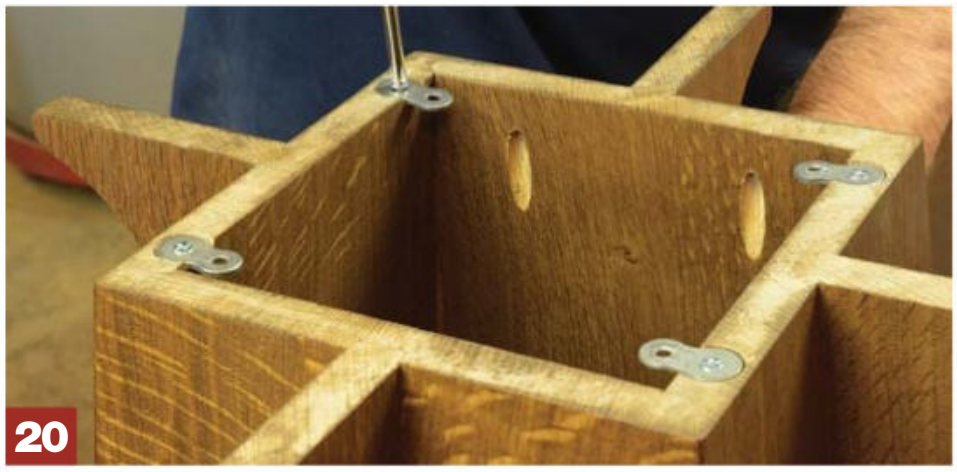


16 Apply glue on the long edges. Use it sparingly near inside faces to minimize squeeze-out where it'd be difficult to remove.

17 Use the angled panel cutoffs for cauls as you add the clamps. Note that you only need to clamp in one direction.

18 Dry fit corbels and mark a cutline using a long, straightedge. This should be about 5°. Trim at the miter saw.

19 Glue corbels in place. For each corbel, you'll need one small parallel clamp and a *GearKlamp* or something similar with a pivoting jaw.



20 Pocket hole screws and figure 8 fasteners? If you're a "belt and suspenders" type of woodworker like me, try using both types of fasteners to anchor the top.

Supplies

- Figure 8 fasteners
- #6 x 5/8" long screws to attach the figure 8 fasteners
- Square drive, pocket-hole style screws, 1 1/4" long

The Big Show

Sometimes gluing a project together can be the most stressful part of the process, but it always helps when the joinery interlocks. That's the case with locking miter joints, especially when you've taken care to rout the same profile on both edges of the panels. Additional care can also be taken by using carpet tape to temporarily attach the four angled offcuts from the panels where you plan to apply the clamps. This extra step provides a square bearing surface for the clamp pads and virtually guarantees a tight glue joint.

Once the long joints have had time to cure, glue the corbels into their respective grooves and confirm they sit flush with the top of the table as you clamp them in place. I found that one GearKlamp inserted through the panel opening and one small parallel clamp on top did the trick.

Fume and Finish

For this authentic reproduction, I used a classic finishing technique. It was fumed with ammonia and wiped with Danish oil plus topcoat. For more on this, check out the article on ammonia fumed finishes on page 62.

Attaching the Top

The top is attached with a combination of figure 8 fasteners and pocket hole screws. Figure 8 fasteners are great because they allow the wood to move but don't anchor the top as securely as screws. As a compromise, I used some of each: four figure-8 fasteners and four pocket hole screws. Just make sure to orient the octagon top so the grain direction matches that of the side panels with pocket holes. As the side panels expand and contract with seasonal changes, so too will the octagon top.

Now stand back and admire your handiwork with this Limbert-style tabouret side table. It works great beside a sofa to hold a cold drink or a special book. When the light through a window highlights the angled shapes and solid white oak panels, you may be reminded, as I often say, what a wonderful designer Charles Limbert was. His work truly deserves to be recreated and celebrated. **PW** — *Willie Sandry*

Did You Know?

Did you know that Limbert used pocket hole screws? It's true! While much of Limbert furniture was constructed with mortise and tenons or large panels glued together, there is historical evidence that pocket holes were employed where appropriate. To see another Limbert reproduction table with pocket hole screws, see the **April 2020** issue of ***Popular Woodworking***. There you'll find plans for the **Limbert no. 146 Oval Library Table**—another fun build!

PROJECT #2213
Skill Level: Advanced
Time: 7 Days
Cost: $300

Watchmaker's Cabinet

Based on watchmaker and spool cabinets, this project is a great way to hone your hand tool skills. **By Logan Wittmer**

PHOTOS BY JACK COYIER

One of my favorite ways to spend my lunch hour is to pop into any one of the dozen antique and thrift stores within a few minutes' drive. While I'm mainly on the lookout for vintage tools to restore and flip, I've found myself recently just browsing the furniture. The always-changing pieces have different styles reflecting what was "in" at the time, different functions depending on when it was built, and countless construction methods. I find an odd joy examining and contemplating these pieces of furniture that span centuries.

A recent find was a small, four drawer cabinet labeled a "watchmaker's cabinet". Upon opening the drawers, it indeed had a gob of small compartments within the drawers that I could envision holding various watch parts and gears. A few booths away, there was an old spool cabinet that shared a similar framework. As I was looking at and comparing these two pieces, I started to think about how nice of size they both were and how they could be used for various places around the house or even the shop. So, here you see my rendition of this watchmaker's cabinet.

The series of 6 drawers are fairly shallow, keeping with the originals that I could find. Plenty deep for spools of thread, watch parts, or carving tools (which is its fate in my shop). It appears that traditionally, these styles of cabinets have been made from about everything. I've seen beech, oak, walnut, cherry ... you name it. When I started digging through my lumber stack at home, I realized I had separated out enough quartersawn walnut throughout the last year or so. There was certainly enough for this entire cabinet. The straight grain works well on the clean lines (in my opinion).

For the drawer sides, back, and some of the interior parts, I started looking at the rest of the lumber I had drying and selected some basswood. All right, I can hear it now. "Basswood is too soft for drawer parts. It's going to wear too fast." Sure, I'll give you that. At least, if I was going to be opening these drawers daily. However, with the occasional use of them, I think they'll be just fine. Plus, a hundred years from now, some stupid magazine editor will be examining this in an antique store trying to figure out why some idiot used basswood.

Sizing Parts by Hand and Eye

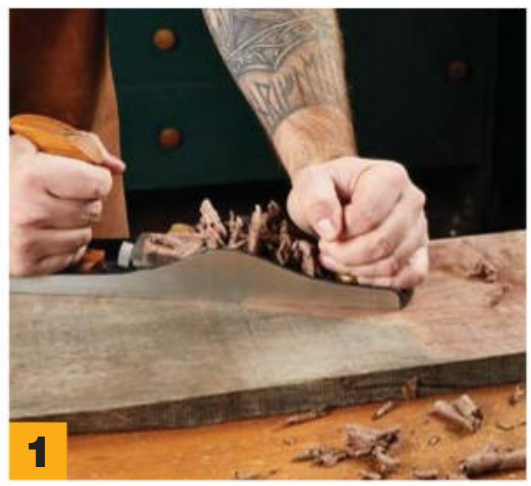
The frame and panel construction of this cabinet lends itself well to hand tools but still offers plenty of challenges. Even though I used hand tools, you'll probably offend someone (but not me) if you invoke a few electrons during this build.

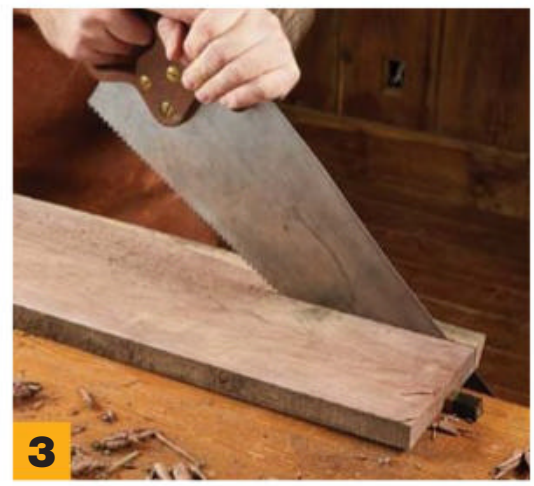
The first thing to do is clean up my rough-sawn boards. This starts by working one surface with a jack plane. The goal here is to get one face of the board flat. I work at a 45° angle across the face of the board to clean it up, then make passes the length to remove any torn-out grain. I'll periodically check the board with winding sticks for twist, and even flip the board onto the bench and see if I can feel any rocking.

Once I'm happy with the flatness of the first face, I'll use a marking gauge to mark the final desired thickness of the workpiece. Then, switching over to a scrub plane, I'll continue to work the surface (still at 45°) down close to the line before finishing with a jack plane and smoother. I don't worry about tear-out too much with a scrub plane—I just make sure to leave enough thickness to clean up the surface after I'm done.

Just as with power tools, after surfacing and thicknessing the parts, it's time to cut them to size. To rip boards, I straighten an edge with my jointer plane, and scribe a cut line. Then, my big *Disston* D-8 makes quick work of ripping parts to size. A couple of swipes of a plane brings the cut edge to the line.

To cut the parts to length, I use a carcass saw with a bench hook. I cut close to my layout lines and then square up the end and sneak up on the length with a shooting board.





1 Start cleaning up the face of a piece of stick with a jack plane. The long sole helps get a flat face, but check the stock for twists.

2 After flattening one face, switch to a scrub plane to quickly thickness the material close to final thickness.

3 A sharp rip saw will cut straight, cleanly, and quickly. If I have a choice, I always use a thumb-hole rip saw.

4 Rough cut parts to length using a carcass saw, but leave the line.

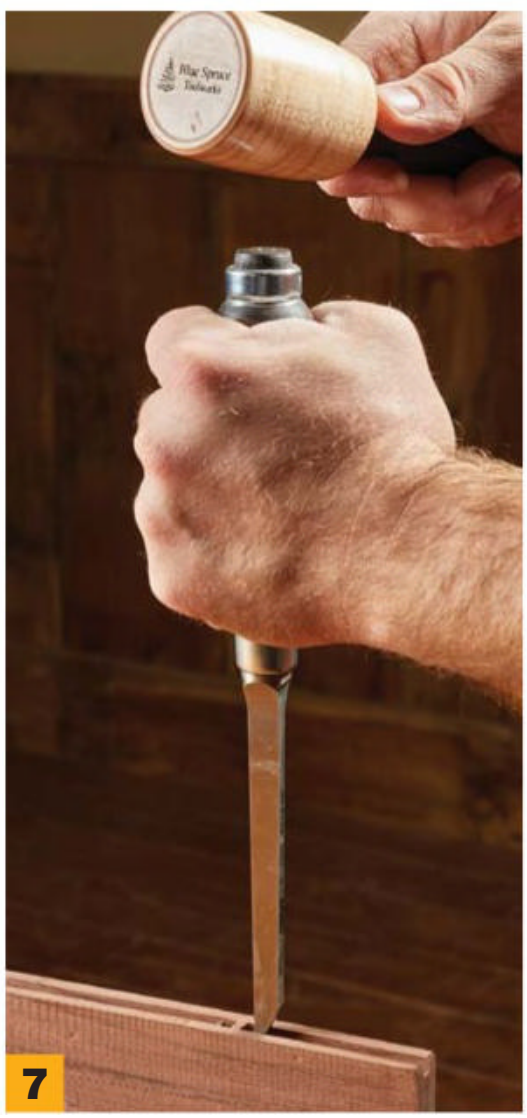
5 Use a shooting board and shooting plane to true up the ends and sneak up on the final length.

6 A plough (English spelling) plane is, in my opinion, one of the most fun hand planes to use. It yields long, curly shavings in a hurry.

7 Create the deep mortise using a mortise chisel.

8 After marking your tenon, use a knife to create V-notches to start your saw in.

9-10 Cutting tenons by hand is a simple practice of seeing your baseline, and cutting to it.



Frame & Panel

Now that we've touched, in general, about surfacing and cutting parts, let's get into the nitty gritty on some of these. The frame and panels that make up the sides and back consist of rails, stiles, and panels. The rails and stiles have grooves to capture thin panels. To create these, I use one of my favorite planes—the plough plane. This single cutter is guided by a fence and creates a groove in the edge of a workpiece. With a plough plane, it's best to start at the far end of the workpiece and make short strokes. After each stroke, work further and further back until you're taking full-length passes.

The stiles have deep mortises that will accept the tenons located on the ends of the rails. The groove I cut in the inside of the parts helps position this mortise. I locate a mortise chisel within the groove and chisel out the mortises in all of the stiles. Hand-chopping mortises can be a little slow, but it's an easy chop, lever out the chip, and repeat.

With the stiles done, it's time to make the mating tenons. After marking the tenon locations with a marking knife, I like to grab my Sloyd knife. As you can see in Photo 8 on the previous page, I use the knife to make a small V-notch along the layout lines. This becomes a starting point for my saw plate. The actual cutting of the tenon is a four-part process. First, I clamp the workpiece in the vise angled away from me and start cutting the cheeks of the tenon. The first cut is at an angle, bringing the teeth just down to the base (shoulder) line. Then, I rotate the workpiece around and make the same cut from the opposite side. This leaves me with a kerf that is down to the baseline but connected with a triangle of waste in the center of the tenon cheek.

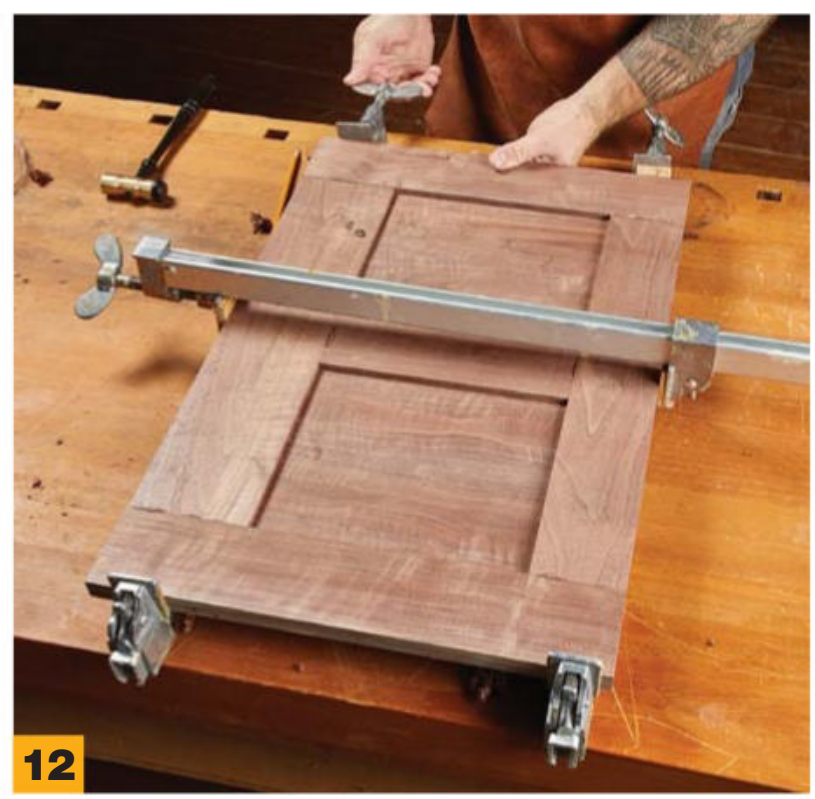
Now all I need to do is cut straight down to the baseline, allowing the partial kerf to help guide the saw. This process makes it pretty easy to cut accurate tenons. Now, it's just a matter of putting the workpiece on the bench hook and cutting the shoulder. Any fine-tuning can be done with a shoulder plane for a good fit.

Assembly Time

After a good while, you'll have all of the tenons, mortises, and grooves cut and fit. Your thin panels will be glued up and planed to thickness. You'll have test fit everything and you'll be ready for a glue-up. I glued these panels up in groups. The two side assemblies are glued up first, then I glued together the back panel. The back is the same as the sides, except with the addition of one vertical stile to break up the back panel.

Now, here's the reality of hand-cutting joinery. You may not be happy with the fit of every single one of your joints. And that's okay. Don't sweat it. If your tenon is a little loose, you can glue a shim on and plane it back down to fit. Or, you can use epoxy to glue the panels together. Unlike other glue, epoxies will actually fill gaps. If you have a pretty good fit, then I'd opt for whatever glue you normally use. For me, that's liquid hide glue.

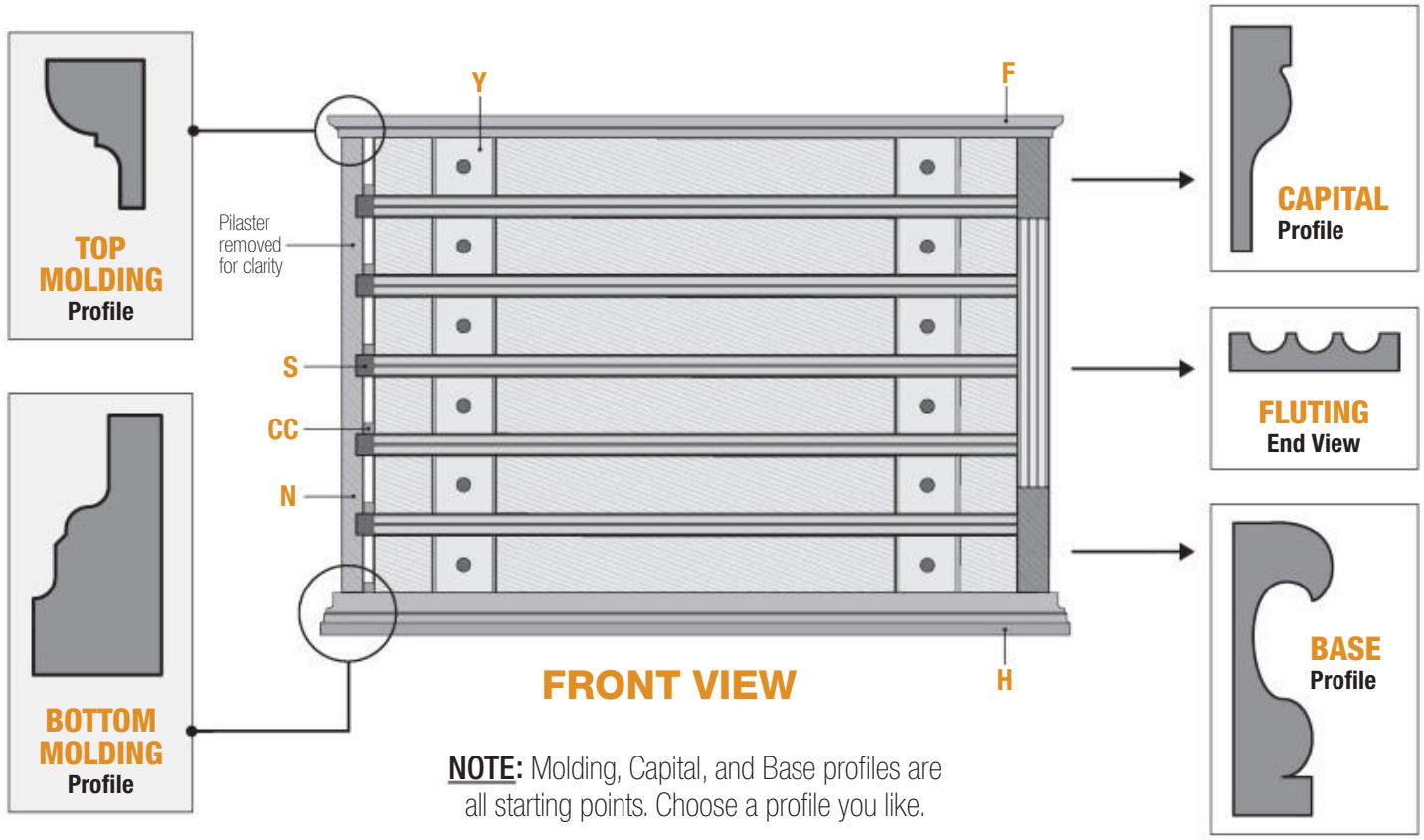
Spread a good even layer of adhesive on the tenons and slip them in place. Slide your panels in next, before capping the other side with the remaining stile. For the back panel, I spread a little glue on the tenon of the middle stile, and used a clamp to hold it in place. Then, the end stiles can be added and clamped. I wait to clean up any squeeze out until it's skimmed over, and at that point I'll just scrape it off. I was taught, in high school, to use a damp rag to wipe off glue, but have found this can pack the open grain of some woods with glue.



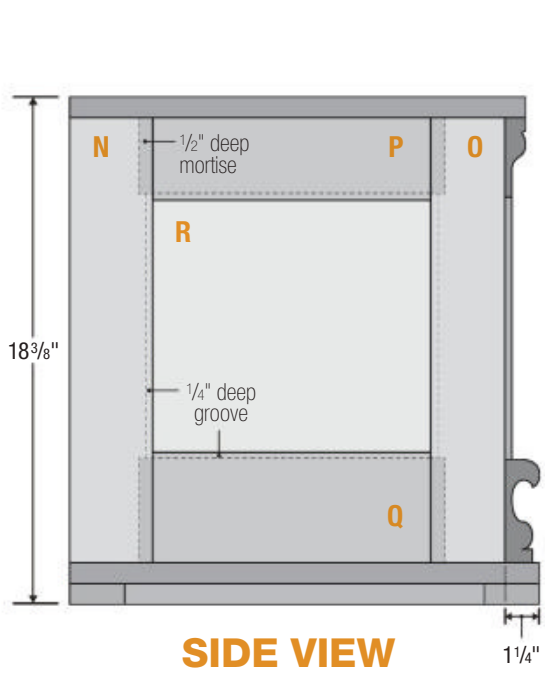
11 The side panels are a straight glue up with two rails, two stiles and a panel.

12 The back panel is similar to the sides, with the addition of one more panel and a middle stile.

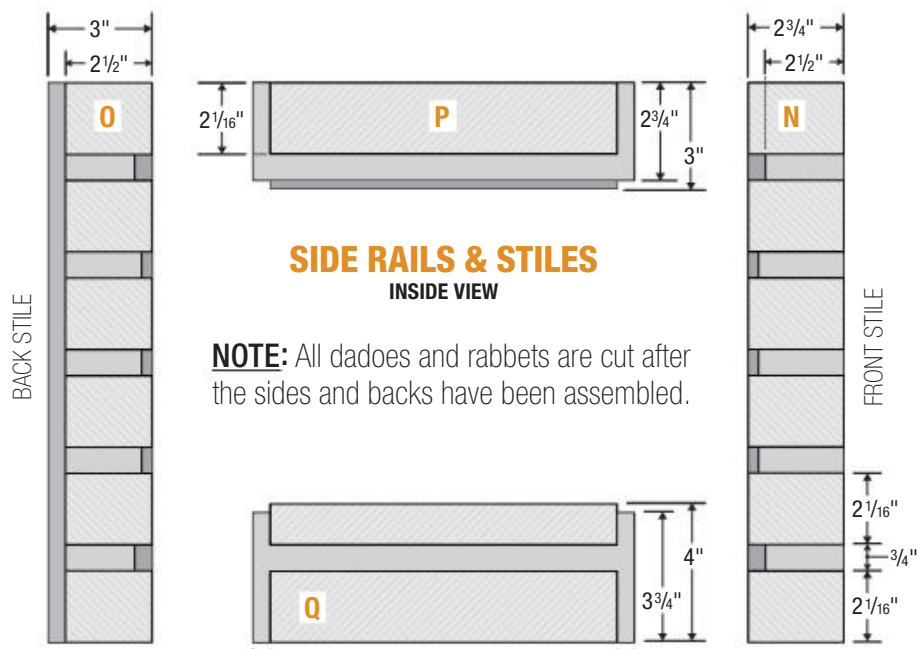
Watchmaker's Cabinet



NOTE: Molding, Capital, and Base profiles are all starting points. Choose a profile you like.

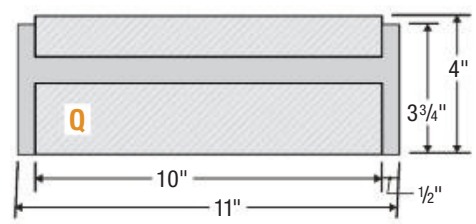


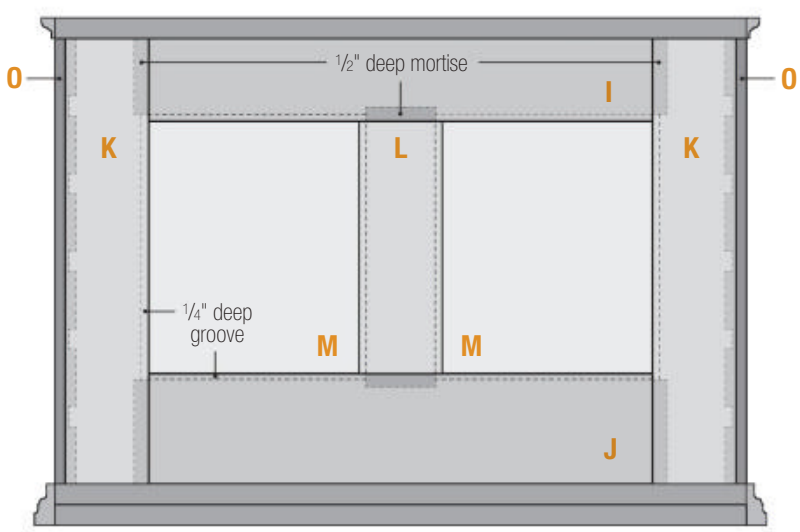
SIDE VIEW



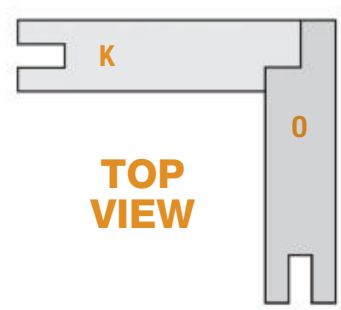
SIDE RAILS & STILES
INSIDE VIEW

NOTE: All dadoes and rabbets are cut after the sides and backs have been assembled.



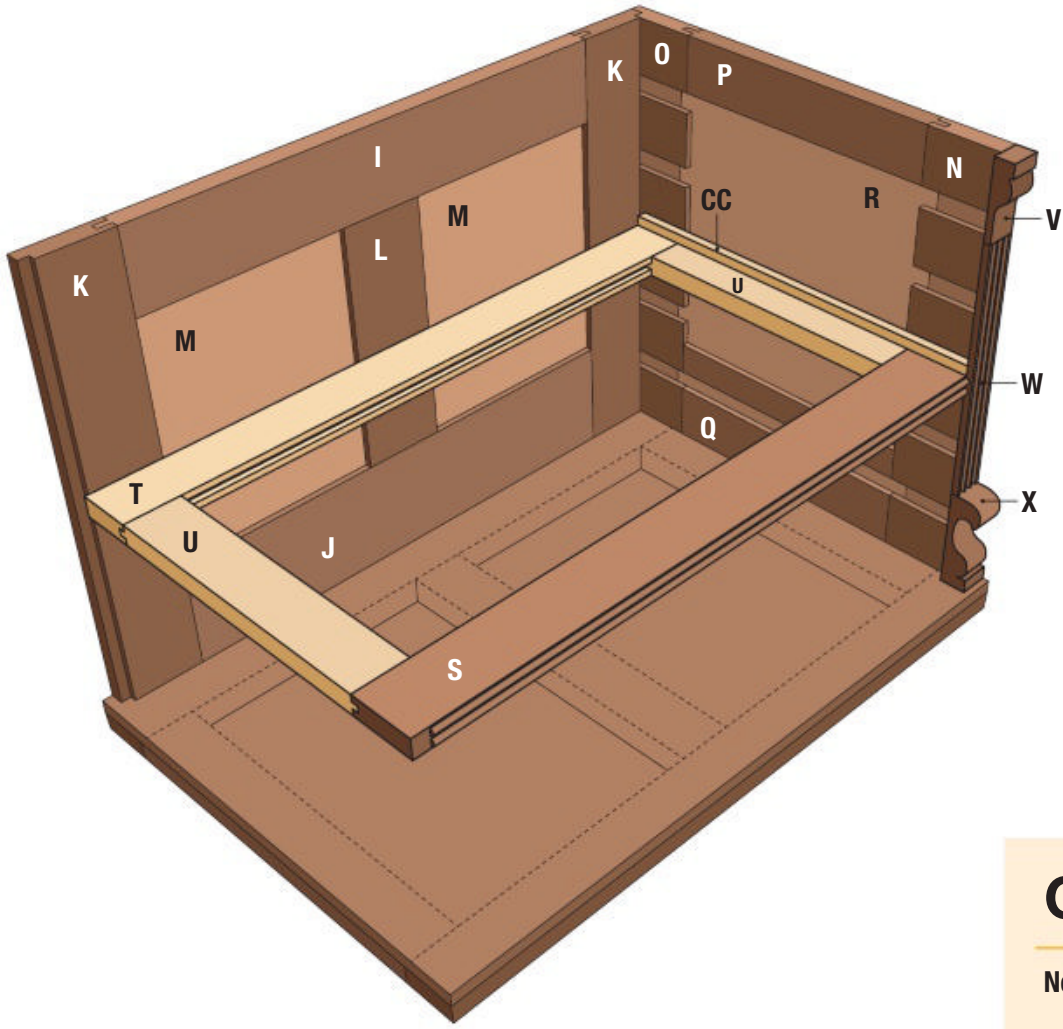


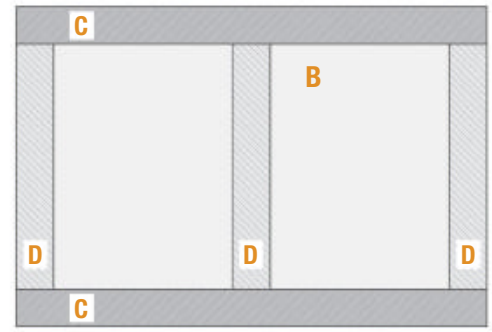
BACK VIEW



TOP VIEW

NOTE: Rabbets on the back panel are ⅜" wide x ⅜"-deep. The mating rabbets on the side panels are ½" wide x ⅜"-deep.

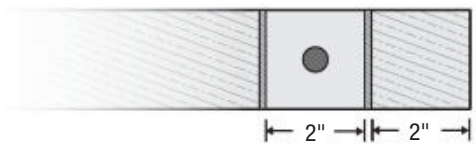




BOTTOM VIEW

NOTE: Blocking is attached to the bottom panel. Long blocking is glued in place, short blocking is nailed.

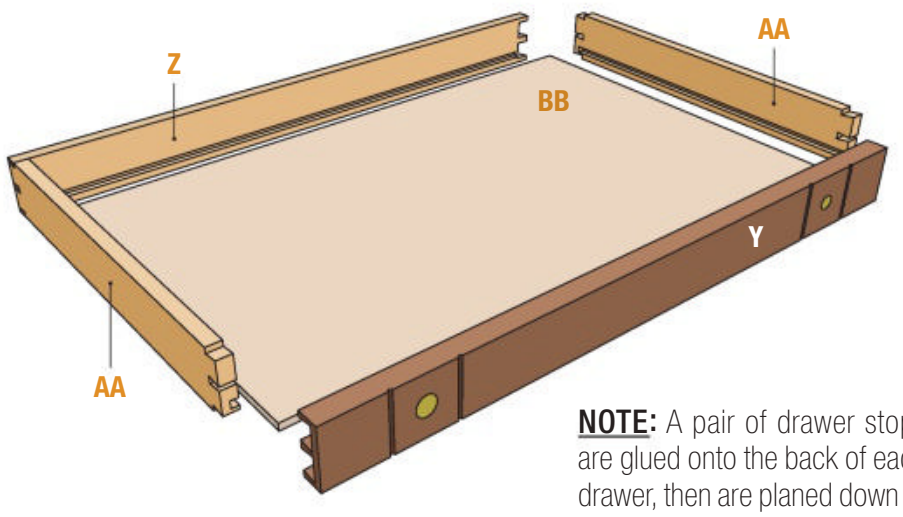
HARDWARE:
Small Dutch Stirrup Drop Pulls
www.paxtonhardware.com



DRAWER FRONT

DRAWER
SIDE VIEW

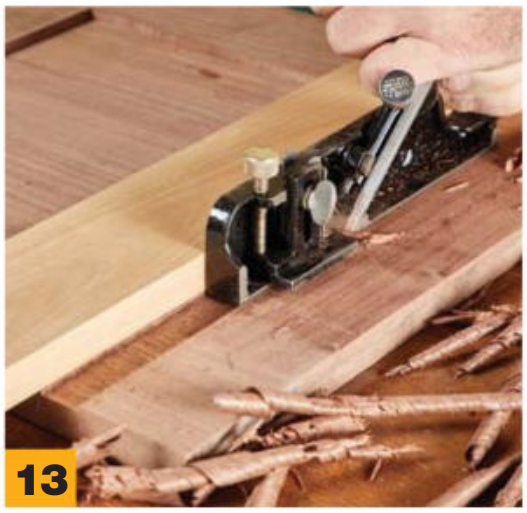
NOTE: Space dovetails based on what looks good to you, or based on your router bit size.



NOTE: A pair of drawer stops are glued onto the back of each drawer, then are planed down to fine-tune the fit of each drawer.

Cut List

No.	Item		Dimensions (in.) T	W	L
TOP & BOTTOM					
1	**A**	Top	3/4	16 3/4	24 1/2
1	**B**	Bottom	3/4	17	24 1/2
2	**C**	Blocking rails	3/4	2	13
3	**D**	Blocking stiles	3/4	2	25
2	**E**	Top molding (L/R)	5/8	3/4	17 1/4
1	**F**	Top molding (front)	5/8	3/4	25 3/4
2	**G**	Bottom molding (L/R)	3/4	1 1/2	17 3/4
1	**H**	Bottom molding (front)	3/4	1 1/2	2
BACK					
1	**I**	Top rail	3/4	3	19 1/4
1	**J**	Bottom rail	3/4	4	19 1/4
2	**K**	Side stiles	3/4	3	16 1/8
1	**L**	Middle stile	3/4	3	9 7/8
2	**M**	Back panels	1/4	8 3/8	9 5/8
SIDES					
2	**N**	Front stiles	3/4	2 3/4	16 1/8
2	**O**	Back stiles	3/4	3	16 1/8
2	**P**	Top rails	3/4	3	11
2	**Q**	Bottom rails	3/4	4	11
2	**R**	Side panels	1/4	9 5/8	11
WEB FRAMES					
5	**S**	Front rails	3/4	2 1/2	23 1/2
5	**T**	Back rails	3/4	2	23 1/2
10	**U**	Stiles	3/4	2	10 1/2
PILASTERS					
2	**V**	Capital	1	1 3/16	2 3/4
2	**W**	Flutings	1/4	1 3/16	9 1/2
2	**X**	Bases	1	1 3/16	3 3/4
DRAWERS					
6	**Y**	Fronts	3/4	2	21 7/8
6	**Z**	Backs	1/2	2	21 7/8
12	**AA**	Sides	1/2	2	14 1/4
6	**BB**	Bottoms	1/4	13 3/4	21 3/8
12	**CC**	Drawer guides	1/2	1/2	14 3/4
12	**DD**	Drawer stops	1/2	1/2	1



13

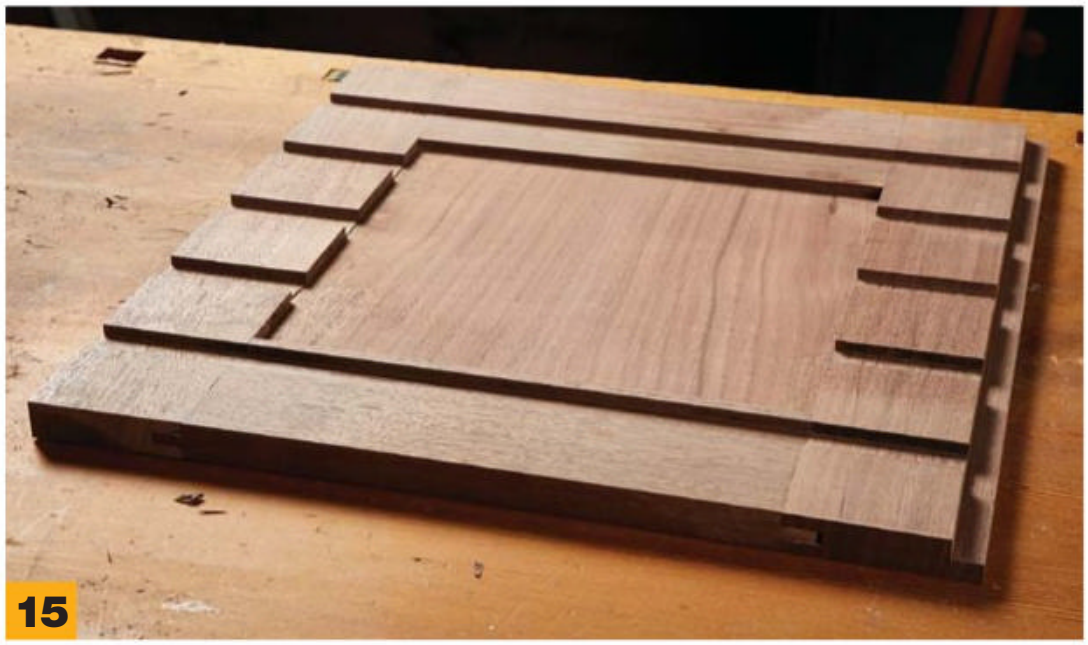
14

13 A metal-bodied dado plane is guided by the fence and creates the dado.

14 Cut a rabbet in both the back panel and the side panels.

15 The finished side, ready to accept web frames.

16 A scratch stock, such as this, can be outfitted with custom made cutters for a variety of profiles.



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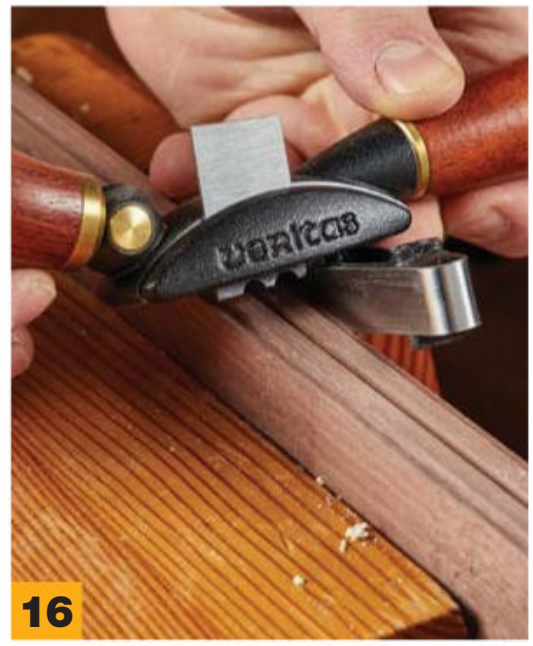


16

Dadoes, Rabbets & Reeds — Oh My!

After the glue has had a chance to cure, I clean up any additional squeeze out with a card scraper. Now it's time to cut a little joinery for the inner workings of the cabinet.

The cabinet interior has a series of web frames that divide the drawer openings. These are connected to the sides via dadoes. Cutting the dadoes can be done in a few different ways. The most simple is like you see in Photo 13. A dado plane, of the correct width, is ran along a fence clamped in place. The spurs on the plane score the fibers before the cutter removes the waste. This leaves a clean cut and a square bottom. Another option is to use a fence and cut the walls with a saw. Then, it's just a matter of chiseling out the waste, and cleaning out the bottom with a router plane.

Now, we can tackle the inner web frames. These guys are frame and panel assemblies but without the panel. The front rail of each web frame will separate the drawers, which needs to be walnut. The remaining pieces are all hidden inside the case, so thats where I used basswood. Creating the web frames is done exactly the same way as the outside panels. Just to point out—even though there aren't panels inside these webs, I did plough a groove the entire way. In my mind, its easier to just groove it with a plough plane instead of chopping mortises.

Before gluing together the web frames, I wanted to add a little bit of detail to the exposed walnut edge. I have seen cabinets with examples of roundovers, some carving, etc. What I chose to do was to create a double reed on the front of each divider. As you can see in Photo 16 above, I used a *Veritas* beading tool with a custom-made cutter. This is nothing more than a piece of card scraper shaped with a file. This style of tool acts like a scratch stock and scrapes the profile in the edge that you're working on. It's slow going and would be much faster with a combination plane. (Which sounds like a missed opportunity for me to add one to my fleet.) But it gets the job done.

The final thing to do before assembly is to lop off the last little bit of reed from the front of the web. A sharp chisel takes care of paring this away. This creates a wide area where we'll install some pilasters a little later. The web frames can now be glued together. When clamping, I used a bit of Styrofoam insulation to protect the reed from getting smashed.

Slow & Steady

At this point, we're ready to bring the web frames to the sides and add the back. Take a few minutes to make sure everything fits as it's intended. Especially sizing parts by hand, you may need to adjust the length on one or two of the web frames that might be slightly oversized. Once you're confident, grab your clamps.

As I mentioned before, I'm a fan of hide glue. However, I wanted even more time while putting this assembly together. So here, I opted to use epoxy. The longer open time allows you to really make sure everything is positioned correctly before the glue sticks everything together. One note, though—as you can see in Photo 18, the web frame has quite a bit of end grain that is going to be sitting in epoxy. The best practice is to spread a layer of epoxy over the end grain to "pack" it first and let it soak in. Once it's absorbed, you can apply more epoxy to actually hold the joint together. This prevents the end grain from wicking away all the adhesive and starving the joint.

With one side panel on the bench, I applied epoxy to the front and back dadoes (although adhesive on just the front dado would have been better to allow for seasonal movement). One by one, I inserted the web frames before adding the opposite side. After the sides were clamped together, I glued the back panel into place, running clamps from front to back to make sure it was good and tight in the rabbet. Give the cabinet case one last look over before setting it aside to work on some drawers.

17

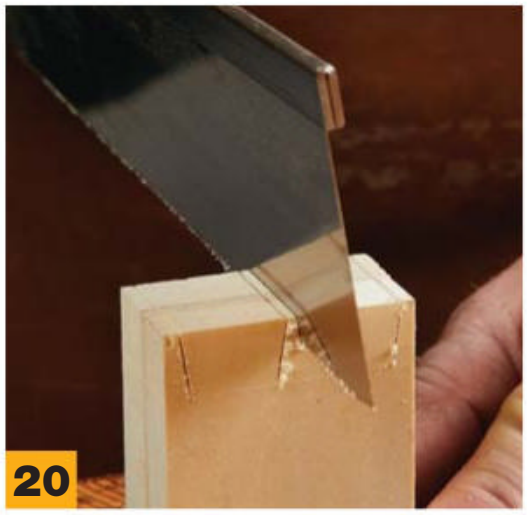
18

19

17 Hunks of blue foam create cushion between the clamps and the reed edge.

18 Stand the web frames into the side panel.

19 Add the opposite side as well as the back.



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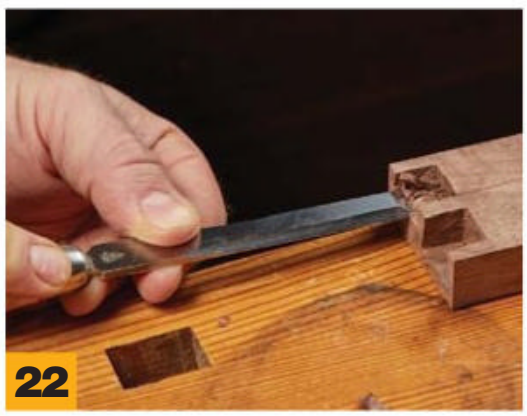


22

23

Dovetailed Drawers

With the few examples of these types of cabinets I looked at in person, the drawers were constructed with a locking rabbet joint. I can only assume that it was a much cheaper way to produce these en masse — however, basswood and walnut dovetail like butter.

I've shown cutting dovetails before, and there's no real trick here. The half-blind dovetails on the front take a little longer to produce than through dovetails, but I like the clean look. The biggest thing that I've found is to cut each and every drawer part to fit its respective opening. And, as you assemble each drawer, mark which opening it's getting placed in.

Before gluing up the drawers (which have a plywood bottom — I won't apologize for that), I spent a little time at the bench to decorate the front of the drawer. Spool cabinets would have a large oval opening where the thread brand would be displayed. Watchmakers would label the front of the drawers with brand names, containing the parts to that particular brand.

I left mine plain, except for a pair of vertical V-cuts framing where the handle would go. This was a common detail that I found in these cabinets. I marked the location and used a small V-gouge to cut them out. After starting the cut, if you want to clean it up and straighten the line, you can touch up each with the corner of a square rasp or file. Assemble the drawers and set them aside for finishing.

Pilasters & Molding

Before attacking some of the decorative bits on this cabinet, it's time to add the top and bottom to the case. These are glued up solid panels. The top is attached with figure-8 fasteners (before you install the bottom). The bottom is attached with screws in slots, allowing for wood movement. Both the top and bottom are wrapped in molding, which we'll add in a little bit.

The pilasters, while decorative, add a striking look to the case. They are made from three parts — the base, some fluting, and a capital. Many examples have a turned column, or some chip carving on the base and capital. However, I chose to sketch out a shape for each that I thought would look good, and cut them out with a coping saw. Once I had a pair cut out, I used double-sided tape to hold them to a carrier board and used a rasp to clean up the profile and make them symmetrical. Once the bases(and capitals) are cleaned up, they can be glued in place. A couple of strips of painter's tape holds them in place as the glue dries.

The fluting can be made the same way the reeding was made earlier — with a scratch stock (or that combo plane that I still haven't ordered...). Otherwise, a router bit will get you there faster. Just make sure you start with a wider piece of stock and rip off the thin fluting once you're done. Then, you can cut it to fit and glue it in place, as you see in Photo 26. It's important to note that the entire pilaster is wider than the case sides, and it butts against the reed-

20 Gang cut the tails for a much faster dovetailing job. The basswood cuts like butter and chisels like a cloud.

21 A soft, secondary wood like basswood allows your dovetails a little more room for error. You'll quickly learn just how compressible the wood is, and how much you need to fine-tune before assembly.

22 Cleaning up the half-blind pins is the longest part of this process. It's a lot of paring and chopping to get a good fit.

23 The decorative lines on the front are best cut in one, fluid motion. You can clean them up with a rasp or float when you're done.

24 By ganging parts together, you can speed up your work and make sure they're symmetrical.

25 Painter's tape is the perfect helping hand to hold small parts while glue dries.

26 The pilasters are flush to the outside of the case and against he reeding.

27 Nail the blocking in place to allow for wood movement. Set the heads to avoid scratching the surface the cabinet is on.

28 Glue the front edge of the side molding and nail the rear of the molding in place. The front moldings can be glued along their length, as they'll move with the top and bottom of the case.

ing we lopped off earlier. This gives the illusion of heavy proportions to the side without excess weight.

Now, laying the case onto its back, I added some blocking to the bottom. This increases the thickness of the bottom. No glue here — we want to allow the wood to move as it will, so I simply nailed these in place. Remember that nails will flex and move. Screws will not.

To dress up the edges, I added some molding around the top and bottom. A simple ogee profile with a fillet is easy to make with a pair of hollows and rounds. Don't fret; I'll get more into making moldings this way in a future article. Just pick a profile you like and rout the molding. When you install it, glue only the front edge of the molding. A nail along the back edge allows the case to expand and contract without being constrained by glue. The same goes for the molding on the top of the case.

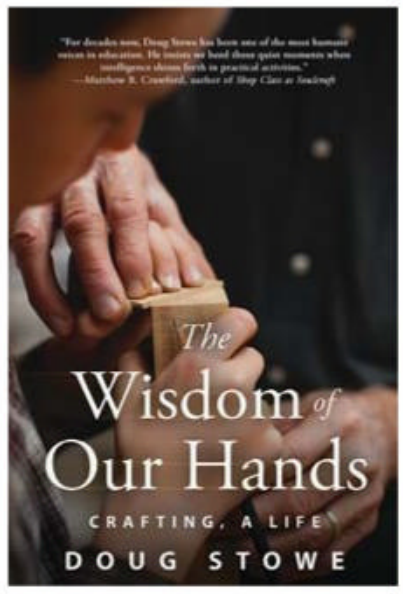
Now, the final piece of work before applying a finish is to add a few drawer runners inside the case. These are just basswood and are glued in place — they block out the drawer opening flush with the pilaster.

The finish I used on this cabinet was my go-to: Danish Oil. After it dried, I added a coat of black paste wax for a slightly used and aged look. The Dutch stirrup pulls are common to these cabinets and are from Paxton Hardware. After fitting and waxing the drawers, it's ready to load up with carving tools. **PW** — *Logan Wittmer*

New and Upcoming Books

Excepts from the authors

If there's one thing to be said about woodworkers, it's that we're old school. In this day and age where the world has gone digital, here we are. We still craft with our hands. We enjoy tactile goods. Heck, we like picking up a book (or a magazine) and reading it. It's with that in mind that I'm thankful for the community of master woodworkers that enjoys sharing their knowledge with us. They put forth a great effort to put some of their knowledge down into the pages of a book, to share with all. Here is a small sample of two new books coming out from two such woodworkers, and I think you will enjoy the books as much as I did.



THE WISDOM OF OUR HANDS

Finding Pleasure with Friends

Excerpt from Chapter 6

A guide to living fully and humanely by learning the wisdom of authentic manual work.

Author: Doug Stowe
Publisher: Linden Publishing
Release Date: March 22, 2022
Price: $16.99

The people who commission work from craftsmen when they have so many choices to do otherwise are very special. There have been many times when I've been asked by someone to make something they'd not seen before and that I'd not made before, yet they've approached me with faith that I would deliver something to enrich their home and their lives... all while they could have instead gone to a furniture store and had something delivered to do the same thing in the same day. I can tell you exactly what it means to the growth of an individual craftsman to have such faith placed in him or her, and through that to find a meaningful life. The implications on a personal level are enormous. Later, I'll discuss what meaning that kind of relationship has within communities and within human culture.

Earlier in the book, I mention that trees have their own stories to tell – where there's a knot there had been a branch and all that. What is our story to tell? Years ago, I attended an opening at a museum in which an artist gave a brief lecture on her work. I had walked through the exhibit before the lecture, trying to make sense of her creations. After her description of process and her motives for creating them, she asked us if the words about her work help any of us to make sense of what we've seen. And, of course, that was the case.

If you were writing a novel, would you first develop a plot line that would help you keep on course and that, you would hope, your readers could follow? If you think of craft as being a form of narrative, can that help you to develop a plot? And does it raise questions? What is that you're trying to say? Is it meaningful to you, and do you think it will be meaningful to others? Having a story line that's meaningful may help in developing work that says something more than "I did it!" – even though "I did it" is often enough. In fact, knowing that the story line or plot of what you want to tell through your work will help to solidify what others recognize as your distinctive style.

In that story line, of course, authenticity matters. At the Nelson-Atkins Museum of Art, I watched an artist in a video go to work with a mallet and carving gouge on wood, crafting her large sculptural objects on display nearby and out in the museum yard. Then I went closer to examine the artist's work. Being a woodworker, I know what tools do and the marks they leave on wood. Discovering that there were no gouge marks, only the markings of a reciprocating saw, left me disappointed. This is not to suggest that the reciprocating saw was not a suitable tool for an artist's creations, but that honesty and authenticity in how you present your work is also important. Had the artist known that a woodworker familiar with tools would be examining her work, she might have actually used the gouge shown in the video at least some part of it, or the video she might have been less deceptive about her work.

At best, each of us has our own

PHOTOS COURTESY OF THE AUTHORS & PUBLISHERS

story to tell. It helps to understand your audience. Who are you making for, and what message do you want to deliver, and is your work honest to your intent? These are the kinds of questions you begin to ask when your hands are busy and the skills of your hands have liberated your mind for its deliberations. So, think. What is the story you want your work to tell?

In my own case, I began with a couple themes that were somewhat related to each other. One was a desire to illustrate how things were made; the other was a desire to awaken folks to the beauty and value of Arkansas's native woods. These themes helped shape my relationship to my customers. I had noticed some were curious about how my inlays on my box were made. Even after I attempted to explain the simple process to them, most folks did not easily understand. I had always been curious about how thing were made, and because of my own curiosity, I was particularly drawn to types of joinery that could be seen and understood. So I chose to use more traditional joinery techniques, which my customers could immediately understand, visibly and proudly in my work. At the same time I chose to use the Ozark Mountains hardwoods I'd come to appreciate and love in their natural colors and with the reverence I'd learned they deserve. I preferred clear finishes that showed the more natural colors of the various woods, and I showed a preference for wide materials over stock sawn and glued into strips. So, my use of visible joinery techniques and reverence for wood became the narrative of my early work.

Sticking to this narrative, I began to build a body of work, including both my small inlaid boxes and other things that were recognizable to others because they were authentic to my own thoughts and objectives. As your hands develop skills, think about the story you and they can tell. Develop your own story line. Or borrow mine if you like. The story of our humanity is a shared one, and we gain strength in our telling of it. My own story will not be diminished by your telling it too. ***– Doug Stowe***

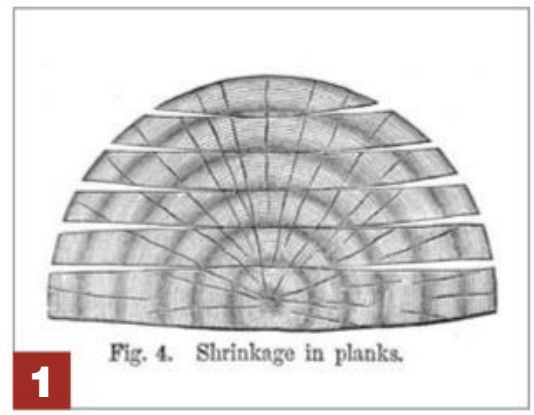


Fig. 4. Shrinkage in planks.

1

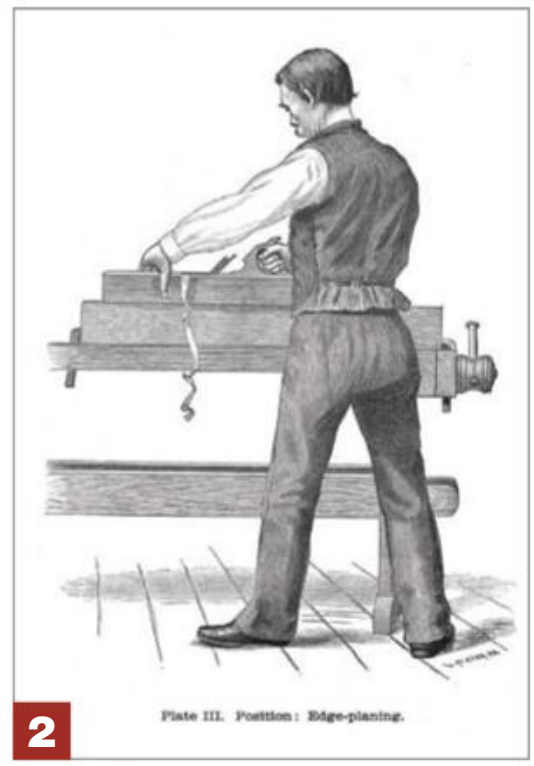


Plate III. Position: Edge-planing.

2

1 From Otto Saloman's *The Teacher's Hand-Book of Slöjd* (Boston: Silver, Burdett, 1904).

2 The planing of wood as shown resembles the Tai Chi movement called "warding off." From the Sloyd Teacher Training Academy at Nääs.

3 Friedrich Froebel's tribute to the village carpenter. From *The Songs and Music of Froebel's Mother Play*, by Susan E. Blow (New York: D. Appleton, 1895).

4 As shown by this drawing from Rudolfs J. Drillis, "Folk Norms and Biomechanics," the hands have been fundamental means through which the world has been shaped, measured, studied, and understood.

3

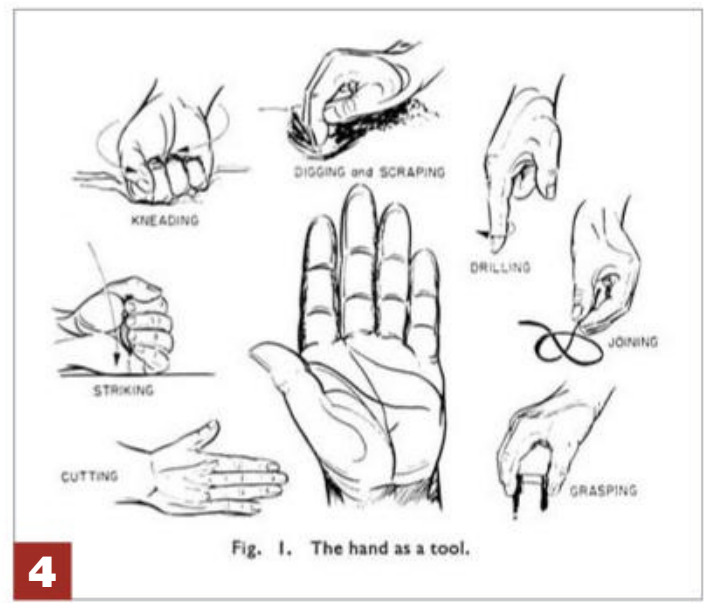
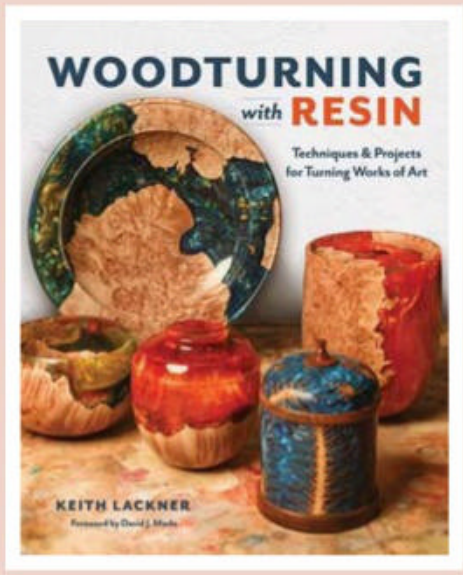


Fig. 1. The hand as a tool.

4



WOODTURNING WITH RESIN

The Three Golden Rules

Excerpt from Resin: An Overview

Techniques and project for turning works of art

Author: Keith Lackner
Publisher: Cedar Lane Press
Price: $24.95

Over the years and hundreds of casts I have developed a set of rules that must be followed to have successful casts. I call these categories the three golden rules of casting: Preparation, Product, and Pressure.

PREPARATION: The Wood

Proper preparation of any wood you are going to have in your project is the first and most important part of casting with urethane resin. You'll need to clean the wood and make sure it is dry in some cases, the wood will need to be stabilized; not there are plenty of types of wood that can skip this step.

Clean the Wood. Select a piece of wood that has been stored in your shop for about a year. The first step in preparation is to make sure the wood is clean. It should be free from dust and dire, and all bark should be removed from the wood. This is important—you do not want anything to come between the resin and the wood. This step will ensure a good bond. You will need these tools: a wire brush, dental picks, and a chisel.

Remove Moisture. Once the wood is completely clean and free of bark, it's now time for the most important step in casting with urethane—making sure to remove all moisture from your process. Moisture and urethane resins do not get along and will case a reaction, whether you're casting with wood, plastics, or just resin.

When you purchase a piece of wood, there will always be moisture in it. There are two terms to describe who the wood is: "dry" and "green." Green wood has a high moisture content usually 20% and above. Even industry-standard dry wood is considered too wet for casting (remember that any contact with water creates unsightly foaming, bubbling, and hazing in urethane resin), but it is closer. Most burls on the marker are freshly cut, with a very high moisture content—something as high as 30-40% moisture. These burls will need to sit until the moisture level gets down to about 17%. When I buy burls, I plan to use them next year. If you cannot wait that long, try to find a seller with burls that are not freshly cut. If you try to dry out burls with a high moisture content, the moisture will leave the wood at a rapid rate, causing internal checking in the wood. It will be hard to see the cracks until you begin to turn the wood, but this is a look you will not want in your finished piece.

The next step is to dry the wood out further by baking it. Since different woods lose moisture at different rates, it is impossible to tell exactly

WHEN TO SKIP AHEAD

You can skip the Preparation rule—it focuses on prepping wood—and start with blanks made of 100% resin, like the handles starting on page 60. This way, if you are new to resin, you can get the feel for the process more quickly. Next, revisit the Preparation info to incorporate some wood that doesn't need stabilized (see list on p. 22). When you feel confident with that, go ahead and add stabilizing wood to your repertoire.

1 Be sure the wood is completely clean. Use a wire brush, dental picks, and a chisel to remove all dirt and bark.

how long this process will take. It will take hours, and for some larger pieces, it could take days. Standard moisture meters do not read below 5%. When your meter does not respond in multiple spots and is cool enough to touch safely with your bare hands, the wood is now ready to be cast right away if it doesn't need to be stabilized.

We just spent all this time and energy removing moisture from the wood; if you are not going to cast or stabilize right away, it is important to wrap the wood in plastic wrap (vacuum sealed bags are even better) until you are ready to go to the next step. Humidity in the air will absorb back into the wood; in a short time, the piece will be back up to 6-9% moisture opening your project up to a failure.

STABILIZING: If Needed

This step is not always needed. It is technically part of the Preparation rule, but because it can sometimes be skipped, I've broken it out here for clarity.

What is stabilizing? Simply put, this is the process of using a vacuum chamber and vacuum pump to create the right conditions to completely saturate a soft piece of wood with stabilizing resin (note this is a different product than urethane resin). This resin is then activated with an external heat source (an oven), which stiffens the wood fibers, making them extremely rigid and hard. This process allows you to take a spalted, or punky, piece of wood and make it as hard and dense as an exotic species like ebony or a piece of Australian burl. You will need to stabilize any wood, including buckeye burl, maple burl, spalted woods, and pine cones.

Not Always Needed. Before we get too far into this aspect of working with resin, I want to state clearly that there are plenty of projects you can create that do not require the additional step of stabilizing wood. You simply create your blank either entirely out of resin, or use a wood that does not need to be stabilized. There are plenty of such woods to choose from: walnut, mesquite, cocobolo, Australian burls, and any very hard and dense wood. You could create turned resin and fusion resin pieces for years and never need to bother with stabilizing. In fact, I didn't start stabilizing woods until after working with resin for 3 years. However, once you are comfortable with resin turning and want to take it to the next level, you can broaden your choices even more by working with stabilized woods. You'll just need three new items: a vacuum chamber, a vacuum pump, and stabilizing resin.

Why Stabilize? There are four main reasons for turners to stabilize. Punky woods have a unique look, but will tear out while turning if unstabilized. We all know about seasonal wood movement; but filling the spaces in the wood with hardened resin that humidity would normally get into, the wood is no longer affected by humidity and will not move. Stabilizing also seals the wood so it cannot be stained by any dye in the resin. For example, if you combine red-dyed resin with a light-blonde piece of maple burl, you will end up with maple that is pinkish in place—mainly the grain. (If you'd rather not get into stabilizing yet, you can work around this problem by using only darker woods, or mica powders instead of dyes with light hardwoods.) The final reason is balance. Resin weighs more than unstabilized wood; it can be very difficult to turn a blank with unbalanced, uncentered weight. Adding stabilizing resin to the wood balances the blank.

Necessary Tools. There are several vacuum chambers on the market, including the Glass Vac and TurnTex JuiceProof. Get a two-stage rotary

WHAT NEEDS TO BE STABILIZED?

Stabilize:

- All soft woods
- Pine cones
- Most burls, including buckeye, maple, and spalted woods

Don't Stabilize:

- Walnut
- Mesquite
- Cocobolo
- Australian burls
- Any extremely hard and dense wood

2-3 The vacuum chamfer removes the air from the wood so the stabilizing resin can penetrate. Glass Vac (left) and TurnTex JuiceProof (right) are two commonly used vacuum chambers.

vane vacuum pump; they can reach a deep vacuum. The goal is to remove all the air from the chamber and the wood. Unlike the air compressor when pressurizing, the vacuum pump must remain on the entire time; don't worry about burning up your pump because running for long periods is what these pumps are designed to do.

Stabilizing at a Glance. Here's a quick rundown of the stabilizing process. Place the wood in a vacuum chamber and completely submerge it in a stabilizing resin (see Photo 3). A vacuum pump then removes the air from the chamber, and more importantly, the wood, creating the opportunity for resin to permeate. When the bubbling stops, that means all the air has been sucked out of the wood and out of the chamber. Open the valve and shut off the vacuum pump, allowing air back into the chamber. (Note: If you turn off the pump without opening the value first, the vacuum inside the chamber can pull oil out of the pump and contaminate the resin.) When the air is reintroduced into the vacuum chamber, it pushes down on the resin; the resin will absorb right away. This is why you will see the resin level drop very quickly when the valve first opens. To ensure deep penetration, the wood must soak in the resin.

Many people think that while under vacuum, the resin is being pulled into the wood, but this simply is not true. Think about submerging a dry sponge under water; very little water will absorb into the sponge because of all the air that is in its way. When you crush the sponge in your hand underwater (like creating the vacuum), the air is released. When you open your hand underwater (like releasing the vacuum), the sponge can absorb all the liquid it can hold.

Now it is time to let the wood soak in the resin. It is difficult to say how long this process will take. I have left large pieces of buckeye in for days to make sure resin gets fully absorbed deep into the wood. Just remember, it's not possible to oversoak the wood.

The stabilizing resin then needs heat to set and become rigid, so the wood goes back into the oven. After any bleed-out is removed from the surface, the wood is ready for casting or storage. Once a piece is stabilized, there is no way for humidity to enter the wood. I've had pieces on the shelf for 6 months that went into a casting with no issues. One trick is to place the block in the oven for a few minutes before casting just to ensure there is no surface moisture on the wood.

PRODUCT: The Resin

Product—urethane resin, itself—is the second golden rule of working with resin. After you figure out how much resin you need to fill your mold (more on p. 38), the next step is to measure and mix the resin correctly. There are a few common mistakes at this stage.

Measure the Correct Amount. Many resin, including the product used throughout this book called Alumilite Clear Slow, have a 1:1 mix ratio by weight. This means that you need equal weights of Part A and Part B resin components. If you do not have the correct measurements, your pieces can turn a hazy white color instead of clear, or there can be soft areas.

The easiest way to measure out the resin is to place a clear container on a scale, tare the scale, pour in Part A until you reach half the needed amount, and then top off with an equal amount of Part B (see Photo on p. 23). Note: It doesn't matter which part you add to the other. Any scale will do, but I prefer a digital scale with a gram weight feature. When you measure by grams, the tolerances are very tight; this will ensure an accurate blend. If you are off a few grams due to a long pour or the scale not catching up in time, you can add a proportional amount of the other part so the extra part is not wasted. However, with the size of the projects we are working on in this book, being a few grams off does not affect the end product.

If you have a brand of resin that measures by volume, you will need a mixing cup that has volume measurements. The process is basically the same as by weight, but you don't need a scale. Simply pour each part to the correct line on the cup.

Mix Thoroughly. If you get lazy with the mixing process, your blanks will not cure properly. I prefer to

4 Pour out the appropriate weight of each resin part.

mix my resin with a drill attachment in clear containers so I can see that it is properly mixed. Don't add color until you can see the base is combined. Use a scraper to make sure any material stuck to the sides and bottom get mixed in—they will not unless you take special care. Don't worry about mixing bubbles into resin because the pressure pot will take care of them.

Add Color. A great part of working with the resin is the ability to add dyes to make your own custom blanks. It is very important to know whether the pigments are compatible with the resin. For example, urethane resins react violently with moisture, so do not use a water-based pigment. I find it best to use dyes sold by the manufacturer of the resin I use, as I know they will be compatible and there will not be any failures in the end product.

Another option is mica powders, which reflect the light to give your blanks a whole new dimension.

It's important to know that not all resins are measured by a 1:1 ratio. Some are measured by volume, other by weight.

Because mica is made of individual small solid colored flakes, you can add batches of resin with different-colored mica powders to a mold to make a swirl of distinct colors (see Photo 5). This is difficult to do with dyes, as they will mix together into a brown color.

I recommend naming the color blends you come up with and keeping a recipe book of how much resin you mixed with what dyes so you can repeat the results.

Timing and Temperature. There are a few important times to remember when working with urethane resin. Open time (also called work time and pot life) is the amount of time the mixed resin will remain in liquid form; a.k.a, how long it remains workable. This is how long you have from the second you combine the parts to get the resin under pressure so that the bubbles are removed before the piece cures. To provide a bit more detail: When you mix Parts A and B, you are kicking off the chemical reaction that ends in a cured blank. The chemical reaction is exothermic, meaning it creates heat as it cures. Open time is how long you have until the heat starts curing the piece; to be precise, manufacturers usually provide an exact temperature and sample mass with their open times. Alumilite Clear Slow had a 12 minute open time (100g at 75° F), so I am to get the mold in the pot in 10 minutes so the pot can pressurize in time.

If you can feel heat coming off your resin, the reaction has begun in earnest and the resin is starting to harden. I do not recommend pouring resin into the mold after that because the pressure pot will not be able to pulverize all of the bubbles; your project will not have the nice, clear quality you want. You also do not want the ambient temperature or the temperature of the resin parts to be too high while working the resin, as that will shorten the open time even further. Most open times are calculated with ambient temperatures of 75° F. As you can imagine, the more resin you mix, the more heat is created. This means that larger batches have an even shorter open time. You can combat this by chilling the parts before mixing.

Demold time is how long it takes until the mixed resin is hardened enough to remove from the mold. Alumilite Clear Slow has a demold time of 4 hours, so I like to leave my pieces in the pressure pot for no less than 4 hours, but I've left pieces in the pot for as long as 2 days. For the most part, 4 to 6 hours is sufficient. I often cast right before the end of the day and let it sit in the pot over-

5 Alumilite Clear Slow is my resin for choice in turning, and is measured 1:1 by weight.

night. This ensures a proper amount of time in the pressure pot. Cure time is the amount of time until the casting has completely hardened. Clear Slow has a cure time of 5 to 7 days. The time period between demold and cure time is when you want to turn the piece. I usually recommend waiting until 1 or 2 days after demold time has passed. Make sure that you read and understand the timing instructions of the particular resin that you are using.

PRESSURE: The Pot

Pressure is the third golden rule. Due to the short open time of urethane resin, a pressure pot must be used to create clear blanks. A pressure pot, in combination with an air compressor, uses air to push on the blank, compressing the air bubbles so they are too small to be seen by the human eye—then the resin cures under pressure so that the bubbles are never visible.

You can purchase a pressure pot (such as the 5-gallon model made by California Air Tools) or convert a painter's pot. Even though most paint sprayers operate at about 20 psi, the tanks are certified for much more. Especially if you want to cast larger pieces, you may have to convert a larger paint pot yourself. That being said, it is best to purchase a ready-made pressure pot unless you are experienced with the conversion process.

Get a compressor with a tank that is the same as or larger than the pressure pot. The air compressor tank can be smaller, but you will find that it will take longer to achieve the required psi due to the constant cycling to fill the pressure pot. You should also do a dry run first with an empty pressure pot to see how long it takes to achieve the desired psi in the pressure pot. The last thing you want is to have your casting fail because your pressure pot takes too long to get up to pressure.

6 A pressure pot is a must-have for working with urethane resin, but is pretty easy to understand.

Optimize Pressure. Before I answer the question about how much pressure to use, let me explain best practices for optimizing pressure through correct mold construction. You want the air pressure to make contact with the resin and do what it needs to do. It is important to never stack anything on top of your mold, or you will be restricting that contact. This is also why I prefer to use horizontal molds—they give the air pressure more surface area to push down on the resin. A larger surface will allow you to use less pressure.

For example: If you are casting a handle blank and you have a horizontal mold that is 6" x 1 1/2" x 1 1/2", that gives you 9 in² of exposed surface that only needs to be pushed down 1 1/2" to pulverize the bubbles. If you are doing the same blank as a vertical pour, it will be a little more difficult as you only have 2 1/4 in² exposed, and the air pressure will need to compress 6" of resin. There is a greater chance of air bubbles in the vertical pour than the horizontal pour.

How Much Pressure? On smaller pours, 40 to 60 psi can be used, but on larger pours (anything over 2" thick), 80 psi is required to ensure there is enough pressure to pulverize all the bubbles. 80 psi is the sweet spot that will work for any project; however, not all pressure pots can handle that level of pressure, and it is very important to NEVER exceed the working pressures of your pressure pot. All pressure pots are not created equal and have different ratings. ***– Keith Lackner***

A WORD ABOUT PRESSURE POTS

As mentioned, if you have a painter's spray pot, it can be converted to a resin pressure pot. There are plenty of videos available online if you are interested or curious about the process. However, make sure you fully understand and are comfortable with the conversion process. If you are uncertain at all, you should definitely purchase a ready-made pressure pot. There are several companies to choose from. Read all the instructions—and any other material you can find—until you understand the ins and outs of working with pressure pots. That said, don't be intimated—plenty of people work safely with them every day. Your pressure pot is key to making beautifully clear resin blanks. You just need to follow your pot's guidelines, and never exceed the pot's pressure rating.

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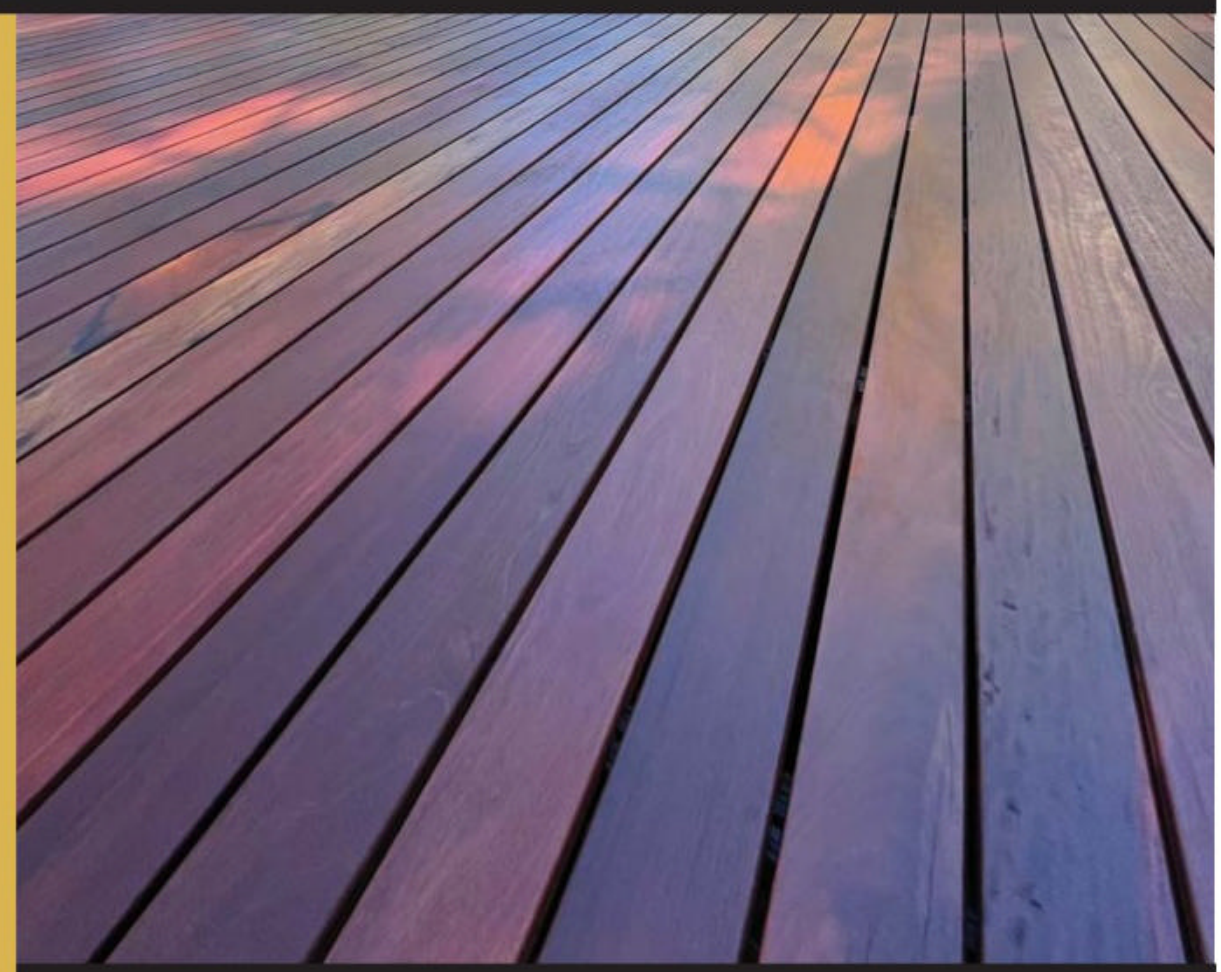

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Oak (Red)	4/4	Select	2.80	$105.00
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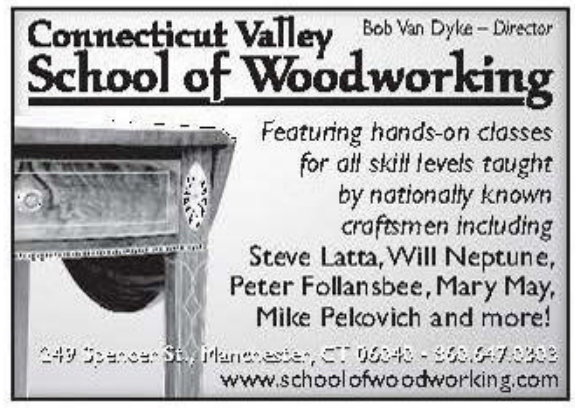

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Traditional Fumed Finish for White Oak

A simple approach to this classic finishing technique.

By Willie Sandry

Finishing options are abound in the woodworking world, however with Arts & Crafts style pieces, you need to get the finish right to complete the feel of the piece. This isn't a project made from birch plywood, where an opaque finish might suffice. There are several finishing schedules I'm happy with, but a traditional piece such as the Limbert No. 239 Tabouret on page 34, I decided to use an ammonia fumed finish. Fumed finishes were synonymous with the Arts & Crafts movement over a hundred years ago and are still being explored to this day.

Preparation is Key

The first step is to tent the table in a fuming chamber. I scabbed together a frame from strips of plywood and covered it with clear plastic sheeting. Be sure to tape the seams to seal in the fumes.

The second step is to procure safety gear for yourself as it is paramount when working with concentrated ammonium. Don't even crack the lid open until you're wearing a respirator with cartridges approved for organic vapors and have donned splash-proof googles. If you can't find your old googles from chemistry class, swim googles will work in a pinch.

1

2

1 With full safety gear in place, lower the fuming chamber over the project and a tray of concentrated ammonia.

2 I chose a fume duration of 4 hours and applied two different *Watco* Danish Oils to fumed and unfumed samples. From left to right: unfumed black walnut, fumed black walnut, unfumed medium walnut, fumed medium walnut. I selected the fumed medium walnut color.

Tips and Tricks

SELECT THE BEST PIECES TO USE.

Remember that with a fumed finish, we're using ammonia to react with the tannins in wood. The goal is to bring out the character of the wood itself, rather than obscure the grain. This process won't hide blemishes in the wood, so select your best white oak pieces for fumed projects. One more word of caution when fuming white oak ... if there's any sapwood in your finished project it won't darken the same way heartwood does.

FUMING DOESN'T WORK WELL WITH ALL LUMBER SPECIES

Fuming only works well with lumber species that contain high tannin levels. If you want to fume other types of wood, be sure to experiment with sample boards

PHOTOS BY THE AUTHOR

Fuming Process Video

To see a short video of the fuming process, check out Willie's YouTube channel, *The Thoughtful Woodworker*.

3 While the fumed white oak looks a little flat, the first hint of oil reveals the deep rich color the fuming process provides.

4 Take your time. When wiping Danish Oil, you can twiddle your thumbs a bit because it doesn't tend to blotch, streak, and create dark spots as some dyes and stains will.

5 Here, a sprayed lacquer finish brings out the rich, nut-brown color of the fumed and oil finish. Two coats with a quick scuff sanding between are all it takes.

Start Fuming Process

Place the table and octagon top in the chamber and slide a container of 28% industrial-grade ammonium inside. Elevate the octagon top on painter's pyramids or something similar to be sure the fumes react to all surfaces. Also include a few scraps of white oak in the fuming tent, which will prove useful in monitoring the coloring process.

Check on the sample boards in the chamber periodically to see how much color change you've achieved. Don't be surprised if the color change with ammonia alone isn't dramatic. The real change happens when you apply oil to the project. What you'll notice is the fumed samples will be much darker than the oil-only control samples. The samples pictures in Photo 2 have only been wiped with Danish Oil at this point. The color becomes even richer once a topcoat is applied.

Apply Watco Danish Oil

Once the project is fumed to your liking, which was 4 hours in this case, let it off-gas for a day or more. The next step is a *Watco* Danish Oil in a medium walnut color. If you've never worked with Danish Oil, you're in for a treat. I find that it's the singular easiest-to-work finish that I've tried. You won't struggle with uneven coverage, dark spots, or smudges that other finishes can cause. Danish Oil, unlike stains and dyes, doesn't seem to get darker if you go over an area twice. In fact, when I'm using more complicated finishing schedules such as stain-over-dye techniques, I need to have a helper in the shop. By contrast, this oil finish can easily be applied by yourself, and you don't even need to hurry!

Lastly, Apply the Topcoat

Once the oil has fully dried, apply the top coat of your choice. Here, I sprayed a lacquer topcoat in a satin finish. Two coats of lacquer with a scuff sanding in between works well for most furniture. The final coat is wet sanded with 1500 grit soft sanding sponges and soapy water. One benefit of fumed finish is the way it penetrates the wood fibers deeply. This means you're less likely to sand through the finish when performing the final scuff sanding and wet sanding steps. With the flexibility this finishing schedule provides, I'm sure you'll be adding this to your finishing favorites as well! **PW** — *Willie Sandry*

Technology in the Shop

Does adding a CNC to your shop make you less of a woodworker?

By Logan Wittmer

A CNC router, or any other "new fangled" pieces of equipment are just that — tools for you to use in your shop, at your discretion.

I consider myself a pretty traditional woodworker. I heavily favor hand tools because that's how I like to work. But, I also realize that there's a particular part of woodworking that I enjoy, so I will supplement my woodworking with power tools to get me to where I want to be faster.

With that being said, there's one comment and mentality that just rubs me the wrong way. And that is "CNC isn't woodworking" and that it somehow makes you less of a woodworker. If you stop to think for a moment and imagine when the first powered table saw came out. I'm not talking about jack-shaft-driven saws. I'm talking about a table saw that hobbyists, like you and me, could have in their shop and, all of a sudden, cut as quickly and efficiently as the big commercial cabinet shops. How did the "real woodworkers" that were doing everything with hand tools feel about that? (And on that note — people that view woodworking with hand tools as downright holy are goofs as well).

Supplement Your Work

As a woodworker that understands the different ways woodworkers work in their shop, I see some huge benefits for some people that want to add a CNC to their outfit. First, CNC's are great for repetitive or extremely precise work. Cutting out dozens of identical widgets? No problem. Quickly zipping out an MDF template for flush routing parts at the router table? Yes please — in a quarter of the time it would take me to make a template. Heck, let's not even talk about repetitive tasks such as drilling cribbage board peg holes (been there, done that at the drill press ... never again).

The CNC is the master of doing tasks that I just don't want to do. Or tasks that just require much more time than I can afford to give them. Let's not forget to mention that adding a CNC to your shop has the potential to turn into a side-hustle. I couldn't begin to tell you how many times I see a post somewhere starting with "Looking for someone in the XYZ area with a CNC to cut/engrave/etc. this for me."

I guess what I'm getting at is that a CNC is a tool to *supplement* your shop. It's no different than adding a router table, bandsaw, or any other piece of machinery to your shop. Does a CNC dovetail with the way that you work? Maybe — that's something that you'll have to decide for yourself. But I want people to think long and hard about the notion that adding a CNC to someone's shop immediately degrades their skill in woodworking. That's just utter nonsense.

In my mind, if you don't want a CNC, cool. Don't buy one. But, keep an open mind. A CNC is, after all, a tool. Adding one into your shop just opens up other paths and expands what is possible. Are they for everyone? No —but if someone wants to add a CNC to their shop, so be it. They can work the way they want, and you can work the way you want.

PW — *Logan Wittmer*

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